Impact of diet deprivation and subsequent overallowance during gestation on lactation performance of primiparous sows[1]

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ABSTRACT: The impact of diet deprivation followed by overallowance during gestation on metabolic status of pregnant gilts and their lactation performance was determined. Gilts were fed a standard diet until day 27 of gestation and were subsequently reared under a control (**CTL**; $n = 28$) or an experimental (treatment, **TRT**; $n = 26$) dietary regimen. The experimental regimen provided 70% (restriction diet, **RES**) and 115% (overallowance diet, OVER) of the protein and NE contents provided by the CTL diet. The RES diet was given from days 28 to 74 of gestation followed by the OVER diet from day 75 until farrowing. Blood samples were obtained from all gilts on days 28, 75, and 110 of gestation, and on days 3 and 20 of lactation to measure concentrations of IGF-1, urea, FFA, and glucose. Milk samples were collected from 12 sows per treatment on day 19 of lactation and sow feed intake was recorded daily throughout lactation. Piglets were weighed at 24 h (after standardization of litter size), and on days 7, 14, and 21 (weaning). The TRT gilts gained less BW than CTL gilts (17.3 vs. 31.7 kg; $P < 0.01$) from days 28 to 75 of gestation and more **BW** (29.5 vs. 21.9 kg; $P < 0.01$) from days 75 to 110, but their overall gain from mating to day 110 was lower (61.4 vs. 67.2 kg; $P < 0.05$). Metabolic status during gestation was affected, with TRT gilts having less IGF-1 and urea, and more FFA than CTL gilts on day 75 ($P < 0.01$), and more urea on day 110 ($P < 0.01$). Growth rate of suckling piglets, sow lactation feed intake, and standard milk composition in late lactation (DM, fat, protein, lactose) were not affected by treatment ($P > 0.10$). In conclusion, diet deprivation of gilts as of day 28 of gestation followed by overfeeding from day 75 of gestation until farrowing did not improve lactation performance. It is likely that the compensatory growth that took place in late gestation was not adequate to illicit beneficial effects.

Key words: diet deprivation, diet overallowance, gestation, milk yield, sows

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INTRODUCTION

Genetic selection and improved management technologies have allowed sows to become more productive in terms of litter size and milk yield. However, milk yield needs to be further increased because growth rate of suckling piglets is not optimal (Harrell et al., 1993). New feeding technologies in gestation, such as supplementation with specific amino acids, phase-feeding, and use of high-fiber diets, have been used to improve

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the performance of lactating sows (Sohn and Maxwell, 1999). Since sow milk yield is affected by the number of mammary secretory cells present at the onset of lactation (Head and Williams, 1991), and rapid mammary accretion occurs in the last third of gestation (Sorensen et al., 2002), several studies have focused on developing feeding strategies to stimulate mammary development in late gestation. Overfeeding a sow during gestation negatively affected mammary development (Head and Williams, 1991), but diet deprivation followed by overallowance during the growing, finishing, and gestation phases increased sow milk yield (Crenshaw et al., 1989). Recent results indicate that using a similar diet deprivation–overallowance dietary regimen in gestation does not increase mammary development (Farmer et al., 2014). However, the level of diet deprivation was too severe to bring about the expected compensatory growth, as evidenced by the lower BW of treated sows compared with that of control sows in late gestation (Farmer et al., 2014). It was hypothesized that reducing the duration of the diet deprivation imposed in early gestation while using a similar overallowance in late gestation could stimulate mammary development via compensatory growth, hence increasing piglet growth rate in the subsequent lactation.

MATERIALS AND METHODS

Animals were cared for according to a recommended code of practice (Agriculture and Agri-Food Canada, 1993) and procedures were approved by the Institutional Animal Care Committee of the Sherbrooke Research and Development Centre of Agriculture and Agri-Food Canada.

Animals and Treatments

Fifty-four Yorkshire × Landrace gilts were bred via AI using pools of semen from Duroc boars of proven fertility. All gilts were fed 2.5 kg of a commercial diet containing 12% CP, 2232 kcal/kg NE, 0.60% lysine, and 6.3% crude fiber from mating until day 27 of gestation. They were then fed 2.5 kg/d of a control (**CTL**; $n = 28$) or an experimental (treatment, **TRT**; $n = 26$) dietary regimen. The CTL diet was formulated to meet NRC requirements (2012). The TRT regimen was designed to restrict growth and then induce compensatory growth by providing 70% (restriction diet, **RES**) and 115% (overallowance diet, **OVER**), respectively, of the CP and NE contents provided by the CTL diet. The RES diet was given from day 28 until day 74 of gestation, followed by the OVER diet from day 75 of gestation until farrowing. These diets are described in Table 1. Representative feed samples were taken weekly from feed bins throughout the experiment for compositional analyses (Table 1). Gilts were

Table 1. Composition of the experimental* and lactation (LACT) diets (as-fed)

Item	CTL	RES	OVER	LACT
Ingredient, g/kg				
Corn	486.2	38.8	584.0	579.1
Wheat, soft	100.0	119.9	100.0	-
Wheat middlings	180.0	250.0	22.3	100.0
Soybean meal (48% CP)	103.5	13.0	212.3	254.1
Oat hulls	100.1	545.4	-	-
Animal fat	-	-	50.0	23.1
Ground limestone	14.9	14.0	14.1	15.6
Dicalcium phosphate (21%)	5.6	6.5	6.9	14.7
NaCl	6.3	6.1	6.3	5.0
Lys. HCl	-	1.3	-	2.3
Met	-	0.4	0.3	0.9
L-Thr	-	0.6	0.4	0.9
L-Tryptophan	-	0.1	-	-
L-Valine	-	0.5	-	0.7
Choline (51.7%)	0.72	0.72	0.72	1.15
Trace mineral and vitamin premix†	2.5	2.5	2.5	2.5
Phytase‡	0.15	0.15	0.15	-
Calculated composition				
DE, kcal/kg	3,115	2,286	3,624	3,432
NE, kcal/kg	2,232	1,559	2,566	2,525
CP, %	13.10	9.22	15.72	18.37
Fat, %	2.59	2.00	7.22	4.95
Crude fiber, %	6.05	20.41	1.95	2.29
Total Lys, %	0.60	0.46	0.80	1.13
Ca, %	0.75	0.75	0.75	0.95
P, %	0.57	0.54	0.50	0.75
Met, %	0.21	0.17	0.27	0.37
Met + Cys, %	0.46	0.35	0.54	0.67
Analyzed composition				
CP, %	12.87	9.95	16.63	18.73
Ca, %	0.76	0.71	0.77	0.96
P, %	0.60	0.59	0.55	0.72
Na, %	0.25	0.23	0.27	0.21
Mg, %	0.20	0.20	0.18	0.20

*Control (CTL), restriction (RES), and overallowance (OVER) diets fed from day 28 of gestation. The RES diet provided 70% and the OVER diet 115% of the CTL diet in the CP and NE contents. The RES diet was fed from days 28 until 74 of gestation followed by the OVER diet for the remainder of gestation.

†Provided the following per kilogram of diet: Cu (copper sulfate), 15 mg; Zn (zinc sulfate), 125 mg; Se (sodium selenite), 0.3 mg; Mn (manganous sulfate), 40 mg; Fe (ferrous sulfate), 100 mg; I (ethylene diamine dihydroiodine), 0.5 mg; vitamin A, 10,000 IU; vitamin D, 1,400 IU; vitamin E, 60 IU; vitamin K, 3 mg; vitamin B_{12}, 20 µg; thiamin, 1.5 mg; riboflavin, 6 mg; panthotenic acid, 25 mg; niacin, 30 mg; folate, 8 mg; biotin, 0.5 mg; and pyridoxin, 3 mg.

‡Phyzyme XP (Danisco Animal Nutrition, Marlborough, UK).

housed in individual gestation pens (0.61 × 1.90 m) and were weighed and backfat thickness was measured ultrasonically (WED-3000, Shenzhen WELLD Medical Electronics Co., Ltd., Schenzhen, China) at P2 of the last rib on days 28, 75, and 110 of gestation, and on days 2 and 20 of lactation. Jugular blood samples were obtained from all gilts on days 28, 75, and 110 of gestation and on days 3 and 20 of lactation.

Throughout lactation, sows were housed in a 1.5 × 2.1 m pen and were fed a commercial lactation diet (Table 1) in two equal meals at a rate of 2.72 kg/d on the day of farrowing (day 0), 4.08 kg/d on day 1, 5.90 kg/d on day 2, 7.71 kg/d on day 3, and then *ad libitum* for the remainder of lactation. Sow feed intake was recorded daily throughout lactation. Litter size was noted at birth and standardized to 12 or 13 piglets (within treatment group) within 24 h of birth. Piglets were weighed at 24 h (after standardization of litter size), and on days 7, 14, and 21 (weaning) of lactation. Piglets had no access to dry feed while suckling so that weight gain could provide an estimate of milk yield. Mortality rate was recorded daily and reported for the first 48 h after farrowing and for the entire lactation period. Representative milk samples were obtained from 12 CTL and 12 TRT sows on day 19 of lactation, by collecting milk from three functional glands (anterior, middle, and posterior) encompassing both sides of the udder after an intravenous injection of 1.0 mL of oxytocin (20 IU/mL; P.V.U. Victoriaville, QC, Canada) was given. Piglets were separated from their dam for 45 min before oxytocin was injected. The post-weaning interval to estrus was recorded for all sows.

Blood Handling and Assays

Blood samples collected in gestation or lactation were used to measure concentrations of IGF-1, urea, FFA, and glucose. Blood sampling was done between 0800 and 1000 h. Blood samples (30 mL) were collected in EDTA-tubes (Becton Dickinson and Cie, Rutherford, NJ), except those for glucose analyses (6 mL), which were collected into tubes containing 12.0 mg of potassium oxalate and 15.0 mg of sodium fluoride to inhibit glycolysis. All samples were put on ice and centrifuged within 20 min at 1,800 × *g* for 12 min at 4 °C, and plasma was immediately recovered and frozen at −20 °C until assayed. Concentrations of IGF-1 were measured with a commercial kit for humans (ALPCO 26-G; ALPCO Diagnostics, Salem, NH) with small modifications as detailed previously (Plante et al., 2011). Validation for a plasma pool from sows was conducted. Parallelism was 101.2% and average mass recovery was 101.3%. Sensitivity of the assay was 0.10 ng/mL. The intra-assay and interassay CV were 4.21% and 4.53%, respectively. Glucose was measured by an enzymatic colorimetric method with a commercial kit (Wako Pure Chemicals Industries Ltd, Richmond, VA). Intra-assay and interassay CV were 2.00% and 1.25%, respectively. Urea was measured by colorimetric analysis using an automatic analyzer (Auto-Analyser 3; Technicon Instruments Inc., Tarrytown, NY) according to the method of Huntington (1984). Intra-assay and interassay CV were 1.18% and 1.42%, respectively. Concentrations of FFA were also measured by colorimetry with a commercial kit (Wako Pure Chemicals industries Ltd). Intra-assay and interassay CV were 3.05% and 6.79%, respectively.

Milk Composition

Whole milk was analyzed for DM, protein, fat, and lactose contents. DM was measured using forced air oven drying (method 925.23; AOAC, 2005). Protein content was determined in duplicates with the micro-Kjeldahl method (Kjeltec Auto System; Tecator AB, Hoganas, Sweden) according to AOAC Method 991.20 (AOAC, 2005), and fat was extracted using an established ether extraction method (method 905.02; AOAC, 2005). Lactose was measured by a colorimetric method using a commercial kit (Megazyme International Ireland Ltd., Bray, Co. Wicklow, Ireland). Intra-assay and interassay CV were 2.09% and 1.17%, respectively.

Statistical Analyses

The MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) was used for statistical analyses. The univariate model used for sow backfat thickness and BW, milk composition, piglet BW, and IGF-1 and metabolic variables in blood included the effect of treatment, with the residual error being the error term used to test main effects of treatment. Repeated measures ANOVA with the factors treatment (the error term being sow within treatment) and sampling day (the residual error being the error term) and the treatment × day interaction were also carried out on piglet BW and all blood variables. The nonparametric Wilcoxon test was used to look at treatment effect on litter size, and the Cochran–Mantel–Haenszel test was used to determine treatment effects on the frequency of stillborn piglets and piglet mortality during the 48 h postpartum or the whole lactation period. Data in text and tables are presented as least squares means ± SEM unless specified otherwise.

RESULTS

During the period when the RES diet was fed (days 28 to 74 of gestation), TRT gilts gained less BW than CTL gilts (Table 2, $P < 0.01$) and also lost backfat, whereas CTL gilts gained backfat (Table 2, $P < 0.01$). On day 75 of gestation, TRT gilts weighed 12.2 kg less than CTL gilts (Table 2, $P < 0.01$), but backfat thickness was not different between gilts from both groups (Table 2, $P > 0.10$). During the period of feed overallowance (days 75 to 110 of gestation), TRT gilts gained more BW than CTL gilts (Table 2, $P < 0.01$) and lost less backfat (Table 2, $P < 0.01$). On day 110 of gestation, TRT and CTL gilts did not differ in BW and backfat (Table 2, $P > 0.10$). The BW gain over the whole period from days 28 until 110 of gestation was lower for TRT than CTL gilts (Table 2, $P < 0.05$), whereas the change in backfat thickness did not differ across treatments (Table 2, $P > 0.10$).

There was a significant treatment × day interaction for circulating concentrations of urea, FFA, and IGF-1 over gestation (Table 3, $P < 0.01$). Analyses done per sampling day showed that at the

Table 2. Weight, backfat thickness and lactation feed intakes of sows [28 control (CTL) and 26 treated (TRT) sows]*

	Groups		
Item	CTL	TRT	SEM†
BW, kg			
Mating	152.3	153.5	2.9
Day 28 of gestation	165.9	168.0	2.8
Day 75 of gestation	197.6[a]	185.4[b]	3.1
Day 110 of gestation	219.5	214.9	3.3
Gain, days 28 to 75	31.7[a]	17.3[b]	1.2
Gain, days 75 to 110	21.9[a]	29.5[b]	1.0
Gain, days 28 to 110	53.6[a]	46.9[b]	1.4
Gain, mating to day 110	67.2[c]	61.4[d]	1.8
Day 2 of lactation	200.3	197.4	2.6
Day 20 of lactation	187.0	186.2	3.3
Loss from days 2 to 20	14.4	11.3	1.8
Backfat, mm			
Mating	16.6	17.0	0.8
Day 28 of gestation	17.9	18.3	0.8
Day 75 of gestation	18.5	16.9	0.8
Day 110 of gestation	17.1	17.0	0.8
Difference, days 28 to 75	0.6[a]	-1.4[b]	0.4
Difference, days 75 to 110	-1.8[a]	-0.3[b]	0.4
Difference, days 28 to 110	-0.8	-1.3	0.5
Difference, mating to day 110	0.5	-0.1	0.5
Day 2 of lactation	16.7	16.7	0.8
Day 20 of lactation	13.7	14.3	0.7
Difference, days 2 to 20	-3.5	-2.7	0.5
Average daily feed intake, kg			
Week 1 of lactation	4.38	4.47	0.24
Week 2 of lactation	5.74	5.85	0.25
Week 3 of lactation	5.61	6.27	0.37
Total lactation feed intake, kg	105.15	109.37	5.33

[a,b]Means within a row with different superscripts differ ($P < 0.01$).

[c,d]Means within a row with different superscripts differ ($P < 0.05$).

*CTL = control, and TRT = treatment regimen, which provided 70% (restriction) and 115% (overallowance) of the CTL diet in the CP and NE contents. The restriction diet was fed from days 28 until 74 of gestation followed by the overallowance diet for the remainder of gestation. Sows were fed 2.5 kg/d throughout gestation and there were no refusals.

†Maximum value.

Table 3. Circulating concentrations of urea, FFA, glucose, and IGF-1 in pregnant and lactating primiparous sows [28 control (CTL) and 27 treated (TRT) sows]*

	Groups		
Item	CTL	TRT	SEM†
Urea, mmol/L			
Day 28 of gestation	5.01	4.94	0.18
Day 75 of gestation	4.80[a]	4.03[b]	0.19
Day 110 of gestation	4.76[a]	5.66[b]	0.27
Day 3 of lactation	6.11	6.98	0.49
Day 20 of lactation	9.95	10.69	0.52
FFA, µEq/L			
Day 28 of gestation	137.34	101.17	18.78
Day 75 of gestation	125.27[a]	275.20[b]	33.14
Day 110 of gestation	342.02	282.55	38.90
Day 3 of lactation	205.87	252.19	54.55
Day 20 of lactation	285.27[c]	171.53[d]	54.99
Glucose, mmol/L			
Day 28 of gestation	3.22	3.33	0.07
Day 75 of gestation	3.25	3.27	0.06
Day 110 of gestation	3.32	3.31	0.85
Day 3 of lactation	4.15	3.91	0.11
Day 20 of lactation	3.76[c]	4.05[d]	0.12
IGF-1, ng/mL			
Day 28 of gestation	82.6	84.2	2.9
Day 75 of gestation	52.2[a]	37.4[b]	2.5
Day 110 of gestation	42.2	44.4	2.4
Day 3 of lactation	102.9	97.9	6.7
Day 20 of lactation	101.5	102.1	9.3

[a,b]Means within a row with different superscripts differ ($P < 0.01$).

[c,d]Means within a row with different superscripts tend to differ ($P < 0.10$).

*CTL = control, and TRT = treatment regimen, which provided 70 (restriction) and 115% (overallowance) of the CTL diet in the CP and NE contents. The restriction diet was fed from days 28 until 74 of gestation followed by the overallowance diet for the remainder of gestation.

†Maximum value.

end of feeding the RES diet (day 75 of gestation), TRT gilts had less urea, more than double the concentrations of FFA and less IGF-1 than CTL gilts (Table 3, $P < 0.01$). After feeding the OVER diet (day 110), TRT gilts had more urea than CTL gilts (Table 3, $P < 0.01$). During lactation, there was a significant treatment × day interaction for glucose ($P < 0.01$), a tendency for a treatment × day interaction for FFA ($P < 0.10$), and a day effect for urea ($P < 0.01$), with values increasing as lactation advanced (Table 3). There were no changes in any measured variables due to treatment on day 3 of lactation ($P > 0.10$), but on day 20 of lactation, TRT sows tended to have less FFA and more glucose than CTL sows (Table 3, $P < 0.10$). There was no change in weekly or total lactation feed intake of sows across treatments (Table 2; $P > 0.10$) and milk DM, fat, protein, and lactose contents on day 19 of lactation were not altered by treatment (Table 4; $P > 0.10$).

The number of live-born piglets did not vary between treatments, being 13.7 and 12.5 ± 0.5 for CTL and TRT sows, respectively ($P = 0.1$). Piglet BW at birth or on days 1, 7, 14, or 21 of lactation was not affected by treatment, nor was BW gain over the lactation period altered (Table 5; $P > 0.10$). There was no difference between treatments on the frequency of piglet mortality that occurred either in the first 48 h postpartum (12 vs. 11 sows with dead piglets for CTL and TRT, respectively; $P > 0.10$) or over the whole lactation period (7 vs. 10 sows with dead piglets for CTL and TRT, respectively; $P > 0.10$), but the incidence of stillborn was greater in CTL than TRT sows (13 vs. 7 sows with stillborn piglets for CTL and TRT, respectively; $P < 0.05$).

DISCUSSION

Findings from the current experiment indicate that there is no beneficial effect of restricting energy and protein intake from days 28 until 74 of gestation and then overfeeding gilts from days 75 until 110 of gestation for subsequent lactation performance. An earlier trial suggested that diet deprivation followed by overallowance during the growing, finishing, and gestation phases could be beneficial in terms of milk yield and mammary gene expression in swine (Crenshaw et al., 1989). Yet, a recent experiment showed that when a similar diet deprivation-overallowance regimen as described by Crenshaw et al. (1989) was used in gestation only, there was no increase in mammary development of late-pregnant gilts (Farmer et al., 2014). It was hypothesized that the level of diet deprivation imposed in early gestation was too severe for the compensatory growth in late gestation to have any beneficial effects. This was suggested by the 12.9 kg lower BW of treated gilts compared with control gilts on day 110 of gestation (Farmer et al., 2014). In the current trial, the duration of the diet deprivation was reduced, starting on day 28 of gestation, while an overallowance similar to previous trials was used in later gestation. As expected, concentrations of FFA at the end of the restricted period were increased due to greater use of energy reserves (Barb et al., 1997; Farmer et al., 2014; Ren et al., 2017) and urea was reduced indicative of a lower supply of proteins (Pedersen et al., 2016). The 4.6 kg difference in BW between TRT and CTL gilts on day 110 of gestation in the current experiment was much lower than that previously seen (Farmer et al., 2014) and was not significant. Nevertheless, the increase in BW of gilts from days 75 to 110 of gestation was not as large as the reduction in BW from days 28 until 75, so that even though compensatory growth did take place in

Table 4. Milk composition on day 19 of lactation ($n = 12$)*

Item	Groups CTL	TRT	SEM†
DM, %	18.78	19.52	0.42
Fat, %	7.30	7.78	0.37
Protein, %	5.38	5.65	0.18
Lactose, %	4.86	4.71	0.11

*CTL = control, and TRT = treatment regimen, which provided 70 (restriction) and 115% (overallowance) of the CTL diet in the CP and NE contents. The restriction diet was fed from days 28 until 74 of gestation followed by the overallowance diet for the remainder of gestation.

†Maximum value.

Table 5. Weight of piglets*

Item	Groups CTL	TRT	SEM†
BW, kg			
Birth	1.43 (12.9)	1.50 (12.7)	0.05
Day 1 of lactation	1.45 (12.3)	1.51 (12.2)	0.05
Day 7 of lactation	2.75 (12.3)	2.80 (11.7)	0.10
Day 14 of lactation	4.52 (11.9)	4.51 (11.7)	0.13
Day 21 of lactation	6.10 (11.9)	6.02 (11.7)	0.20
BW gain, kg			
Days 1 to 21	4.65	4.50	0.17

Average numbers of piglets per litter are shown in parenthesis.

*CTL = control, and TRT = treatment regimen, which provided 70 (restriction) and 115% (overallowance) of the CTL diet in the CP and NE contents. The restriction diet was fed from days 28 until 74 of gestation followed by the overallowance diet for the remainder of gestation.

†Maximum value.

late gestation it was likely not important enough to stimulate mammary development. This hypothesis is substantiated by the fact that circulating IGF-1 concentrations were lower in TRT than CTL gilts on day 75 of gestation and were not greater on day 110 of gestation. Lower IGF-1 concentrations in animals with a slower BW gain were expected due to the positive relationship between IGF-1 concentrations and growth rate in growing pigs (Owens et al., 1999). Taking into account the important role of IGF-1 for mammary development in rodents (Kleinberg and Barcellos-Hoff, 2011) and for mitogenesis of mammary epithelial cells in ruminants (Forsyth, 1996), one might suggest that for a late gestation compensatory feeding strategy to have beneficial effects on lactation performance it would need to increase IGF-1 concentrations.

The compensatory feeding regimen was imposed in gestation only in the present trial, because when a feeding regimen similar to that of Crenshaw et al. (1989) was used in the growing-finishing period, there was no beneficial effect on mammary development either at puberty (Farmer et al., 2012a) or at 110 d of gestation (Lyvers-Peffer and Rozeboom, 2001; Farmer et al., 2012b). In studies by Farmer et al. (2012a, 2012b), the greater BW gain observed by Crenshaw (1990) in treated gilts at the end of the growing-finishing period was not seen and in the study by Lyvers-Peffer and Rozeboom (2001), BW of gilts was not reported. In fact, gilts subjected to the restricted and overallowance feeding regime weighed 6.2 kg less at puberty than control gilts (Farmer et al., 2012a). Differences in the type of fiber used and in feed composition were thought to be the cause of this discrepancy. Previous results (Farmer et al. 2012a, 2012b) combined with current results therefore question the hypothesis that the beneficial effect seen by Crenshaw et al. (1989) on sow milk yield was mostly due to compensatory growth in late gestation. It may be that a feeding regime that could bring about the 8.2 kg BW advantage of treated gilts at the end of the growing-finishing period in Crenshaw's study would be beneficial for mammary development and future milk yield. However, circulating concentrations of IGF-1 were not measured in the study by Crenshaw et al. (1989), so it is unknown if the beneficial effect on sow milk yield was mediated through this growth factor.

The lack of treatment effect on circulating concentrations of IGF-1 on day 110 of gestation, the presence of only tendencies for decreased FFA and increased glucose in TRT vs. CTL gilts on that same day, and the similar lactation feed intakes across treatments are in agreement with the unaltered milk composition. The similar birthweight of piglets across treatments also indicates that fetal growth was not affected even though there may have been a positive effect on the incidence of stillborns. Yet, the number of animals used was too low to determine such an effect and this needs to be corroborated in future studies. Ren et al. (2017) recently demonstrated that feed restriction or overfeeding of gilts during three short periods of gestation did not affect litter performance. Even though growth performance of gilts was increased during those periods when they were fed twice the maintenance requirements, it did not lead to beneficial effects during the subsequent lactation. Therefore, altering growth rate of gilts during gestation may not be an adequate strategy to enhance mammary development or the changes incurred need to be more prominent to have an effect.

In conclusion, diet deprivation of gilts as of day 28 of gestation followed by overfeeding from day 75 of gestation until farrowing did not improve lactation performance. It is likely that the compensatory growth that took place in late gestation was not adequate to illicit beneficial effects on mammary development because IGF-1 concentrations were not increased.

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