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EFFECT OF ENERGY SOURCE PRIOR TO PARTURITION AND DURING LACTATION ON PIGLET SURVIVAL AND GROWTH AND ON MILK LIPIDS[1,2]

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SUMMARY

Two experiments were conducted to determine the effect of level and source of energy fed to sows prior to parturition and during lactation on birth weight, gain, and survival of piglets and fat content of the dam's milk.

The first experiment involved 30 gilts and nine sows. The gestation control diet, providing 5,750 kcal of metabolizable energy (ME)/dam/day, was supplemented with either stabilized tallow or cornstarch, thus forming two additional diets, and fed at levels to provide 9,300 kcal of ME/dam daily. Treatments were initiated on day 100 of pregnancy and continued until parturition. Immediately following parturition, lactation treatments were imposed for a 14-day period. The lactation control diet contained 3,034 kcal ME/kg and was supplemented with 20% stabilized tallow to form a second diet that contained 3,843 kcal of ME/kg.

The second experiment was a replicate of experiment 1, involving 17 gilts and 18 sows and provided additional information on fat content of the dam's milk and postweaning growth and efficiency of feed utilization by the piglets.

Pigs reared on sows fed tallow during lactation had an 81.6% survival rate at 14 days of age, which was higher, but not significantly different, from that observed for the controls (79.2%). Percent piglets weighing ≤ 1,000 g at birth surviving to 14 days was higher, but not significantly different for those reared on sows fed tallow as compared to controls (53.4% *vs* 43.4%, respectively). This difference in survival rate among the smaller piglets was established as early as day 2 and maintained through day 14.

Addition of tallow to the diets of dams during the gestation period increased fat content of colostrum compared to dams fed the control and cornstarch diets (8.94% *vs* 6.77%, 5.57%) but this increase was not sustained throughout lactation. Administration of tallow immediately following parturition increased ($P<.01$) milk fat for the entire lactation period in comparison to the controls (10.04 *vs* 8.10).

The effect of the dam's gestation-lactation diets upon subsequent performance of pigs fed an identical diet to approximately 95 kg was determined using average daily gain, feed intake and feed efficiency as response criteria. Pigs in each of the gestation-lactation subclasses responded similarly with no significant differences observed for those traits tested.

(Key Words: Baby Pig, Tallow, Survival, Milk Fat, Gain, Feed Efficiency.)

INTRODUCTION

Survival of the piglet between birth and weaning is an important factor in the assessment of pig productivity. It is during this stage of postnatal life that a major number of baby pigs die. According to the Agricultural Research Service (1965), about 25% of the pigs born alive in the United States die before weaning.

Two of the major reported causes of piglet mortality are crushing by the sow and congenital weakness (Hutchinson *et al.*, 1954; Baumann *et al.*, 1966; Sharpe, 1966; Fahmy and Bernard, 1971) but nutritional inadequacy is perhaps the fundamental reason for occurrence of weakness and a contributing factor to crushing. Intake of adequate nutrients, particularly energy substrates, during the early hours of postnatal life is apparently more essential to the piglet than the newborn of other species, as the piglet succumbs to starvation more readily (Sampson *et al.*, 1955; Goodwin, 1957).

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The rate of piglet survival to 21 days was increased when corn oil was added to a basal diet of sows from the 109th day of pregnancy to parturition when compared to sows receiving a diet with an equal amount of additional metabolizable energy in the form of cornstarch (Seerley *et al.*, 1974). A marked improvement in survival rate of piglets weighing ≤1,000 g at birth was also reported for piglets in the corn oil group.

Bleachable fancy tallow is a lipid source that is of animal origin and is commercially available. It differs from corn oil in fatty acid type and is more highly saturated (Fuller, 1973). The objectives of the present study were to determine if dietary energy level (5,750 *vs* 9,300 kcal ME) and source (tallow *vs* cornstarch) prior to parturition, and energy source during lactation have an effect on quantity of milk lipids and piglet survival rate and postnatal growth.

EXPERIMENTAL PROCEDURE

Trial 1. Thirty-nine crossbred (Hampshire × Yorkshire × Duroc) first (30) and second (9) parity gilts and sows, respectively, were bred to farrow during the months of November and December. Gestation and lactation diets were the main factors in a completely randomized design with a 3 × 2 factorial arrangement of treatments consisting of three gestation and two lactation diets. Allotment to treatment was at random within parity. Due to poor conception or failure to maintain pregnancy (not attributable to dietary treatment), a disproportionate number of females remained in the gestation treatments.

All females received 1.82 kg of a corn-soybean meal diet (table 1, diet G_c) daily until day 100 of gestation, when dietary treatments were imposed. Diet G_c provided approximately 5,750 kcal of metabolizable energy (ME) and served as the control treatment. Females allotted to dietary treatments G_t and G_{cs} received additional energy in the form of either stabilized tallow[3] or cornstarch[4], respectively. They were fed at the rate of 2.27 kg and 2.77 kg per head per day, respectively, and each provided approximately 9,300 kcal of ME. Fifteen, 10 and 14 females remained in the respective treatment groups (G_c, G_t, G_{cs}) and of these, 20 and 19 females were allotted to receive one of two lactation diets (table 1, L_c and L_t, respectively). Diets L_c and L_t provided approximately 3,030 and 3,840 kcal ME/kg of diet, respectively. Metabolizable energy values were calculated using information provided in table 1. A schematic of the gestation and lactation treatments is provided in table 2.

Females were weighed and placed in farrowing crates 110 days following mating. Immediately following parturition, lactation treatments were imposed and fed *ad libitum* for a 14-day period. Diet L_c served as a corn-soybean meal control while diet L_t contained 20% stabilized tallow in addition. Diet L_t was formualted to provide an equal intake of nutrients on the assumption that feed intake would be depressed approximately 15% due to dietary energy density.

Birth weight was recorded within 12 hr after birth. Overall survival rate and gain were recorded at 7 and 14 days, whereas survival rate among piglets weighing ≤1,000 g at birth was recorded on days 1, 2, 3, 7 and 14. Sows were weighed within 24 hr of parturition and again on days 7 and 14. During the 14 day postnatal period, the only nutrients piglets received were those obtained by nursing the dam.

Trial 2. Trial 2 was similar to Trial 1 but was conducted to provide additional information on fat content of dam's milk, postweaning gain and efficiency of feed utilization by the Gestation and lactation treatments defined for experiment 1 were repeated using 35 first (17) and second (18) parity females. Fifteen, 12 and eight females were assigned to receive gestation diets G_c, G_t and G_{cs} and of these, 18 and 17 females were allotted to receive lactation diets L_c and L_t, respectively. Lactation treatments were continued until day 21. Parturition occurred during the month of June.

Milk samples were obtained from all first parity females immediately following parturition and at weekly intervals by hand milking. On days 7, 14 and 21, 40 IU of oxytocin were injected intramuscularly to effect milk release. Milk samples were frozen by placing them on dry ice, and stored at −10 C until analyzed. Prior to analysis, milk samples were allowed to thaw overnight in the refrigerator and then equilibrated to room temperature (Shahani,

[3] Bleachable fancy tallow, National By-Products, Bellevue, NE.

[4] Douglas-Pearle Cornstarch, Penick and Ford Ltd., Cedar Rapids, IA.

TABLE 1. COMPOSITION OF GESTATION AND LACTATION DIETS, TRIAL 1 AND 2

Ingredient, %	Internat'l Ref. No.	Gestation diets			Lactation diets	
		Control (G_c)	Control + tallow (G_t)	Control + cornstarch (G_{cs})	Control (L_c)	Control + tallow (L_t)
Ground yellow corn	4-02-931	80.80	64.60	54.60	63.62	31.80
Soybean meal	5-04-612	14.50	11.60	9.80	17.90	26.25
Beet pulp	4-00-669	...	...	...	10.00	11.90
Wheat bran	4-05-191	...	...	...	2.50	2.95
Dehydrated alfalfa meal	1-00-023	...	...	...	2.50	2.95
Cornstarch	4-02-882	...	...	32.40	...	...
Tallow	4-07-880	...	20.00	...	...	20.00
Dicalcium phosphate	6-01-080	2.55	2.05	1.70	1.81	2.15
Calcium carbonate	6-01-069	.60	.50	.40	.12	.15
Sodium chloride (iodized)		.50	.40	.35	.50	.60
Trace mineral premix		.05[a,b]	.05[a,b]	.05[a,b]	.05[d]	.06[d]
Vitamin premix		1.00[a,c]	.80[a,c]	.70[a,c]	1.00[e]	1.19[e]
Total		100.00	100.00	100.00	100.00	100.00

[a]The concentration of the trace mineral and vitamin premix is given for diet G_c. Females receiving diets G_t and G_{cs} received a different concentration of minerals and vitamins but the same total amount. Refer to table 2.

[b]Contributed the following in mg/kg of diet G_c: Zn, 100; Fe, 50; Mn, 27.5; Cu, 5.0; Co, 0.5; I, 0.75.

[c]Contributed the following per kg of diet G_c: vitamin A, 5500 IU; vitamin D_3, 440 ICU; vitamin E, 22.00 IU; riboflavin, 2.86 mg; pantothenic acid, 22.00 mg; niacin, 22.00 mg; choline chloride, 220.02 mg; vitamin B_{12}, 22.00 μg; menadione sodium bisulfite, 2.20 mg in a ground corn carrier.

[d]Contributed the following in mg/kg of diet L_c/L_t: Zn, 100/120; Fe, 50/60; Mn, 27.5/33.0; Cu, 5.0/6.0; Co, 0.5/0.6; I, 0.75/0.95.

[e]Contributed the following per kg of diet L_c/L_t: vitamin A, 5500/6545 IU; vitamin D_3, 440/524 ICU; vitamin E, 22.0/26.2 IU; riboflavin, 2.86/3.40 mg; pantothenic acid, 22.0/26.2 mg; niacin, 22.0/26.2 mg; choline chloride, 220/261.8 mg; vitamin B_{12}, 22.0/26.2 μg; menadione sodium bisulfite, 2.20/2.62 mg, in a ground corn carrier.

TABLE 2. EXPERIMENTAL DESIGN

Arrangement of treatments[a] 3 × 2 factorial

Gestation (Day 100 to parturition)	G_c (30)	G_t (22)	G_{cs} (22)
Lactation (Parturition to weaning at 14 days)	L_c (16) L_t (14)	L_c (11) L_t (11)	L_c (11) L_t (11)

Treatment	Gestation diets: Feeding rate (kg/sow/day)	ME intake[b] (kcal/sow/day)
Control (G_c)	1.82	5750
Control + tallow (G_t)	1.82	5750
	.45	3575
	2.27	9325
Control + cornstarch (G_{cs})	1.82	5750
	.95	3534
	2.77	9284

Treatment	Lactation diets: Added tallow %	Feeding rate	ME (kcal/kg diet[b])
Control (L_c)	. . .	*ad libitum*	3034
Control + tallow (L_t)	20	*ad libitum*	3843

[a]Number in parentheses represents the number of females in each treatment (trials 1 and 2).

[b]Calculated values. Reference numbers provided in table 1 for gestation and lactation diets, respectively.

1976)[5]. Fat content of the milk was determined by a Milko-Tester[6].

In order to study some of the longterm effects on piglets whose dams were fed the gestation and lactation diets, a growth trial was conducted. Piglets were weaned on day 21, fasted (water given) for 24 hr and given an 18% protein starter diet (table 3) for approximately 3 days. Three piglets, two male and one female, were then randomly chosen from each litter and placed on the growth trial. Average initial weight of the pigs was 5.8 kg. The piglets were housed in an environmentally controlled room with concrete floor (1/3 slotted) and partitions. Each pen contained four piglets whose dam received the same gestation and lactation diet. The piglets had access to automatic waterers, self-feeders and supplemental radiant heat lamps. All piglets chosen for the study continued to receive an 18% protein starter diet until the pen of four averaged approximately 20 kilograms. Pigs were then removed to a totally enclosed building having 100% slotted floors and changed to a 15% protein diet (table 3) until approximately 95 kg when the experiment was terminated. Average daily gain (ADG), average feed intake (ADFI) and feed efficiency (F/G) were used as response criteria.

Litter data were pooled with Trial 1 and analyzed by analysis of variance procedures (Harvey, 1960). Orthogonal linear contrast compari-

[5]Shahani, K. M. 1976. *Personal communication.* Department of Food Science and Technology, University of Nebraska, Lincoln, NE.

[6]Milko-Tester MK II, Foss America Inc., Fishkill, NY.

TABLE 3. COMPOSITION OF DIETS FOR THE GROWING-FINISHING STUDY, TRIAL 2

Ingredient, %	Internat'l Ref. No.	Diet	
		Starter	Growing-finishing
Ground yellow corn	4-02-931	56.40	81.00
Soybean meal	5-04-612	23.20	15.51
Sucrose	4-04-701	10.00	...
Lard	4-04-790	3.00	...
Dried brewers yeast	7-05-527	1.00	...
Dried fish solubles	5-01-971	2.50	...
Dicalcium phosphate	6-01-080	1.96	...
Calcium carbonate	6-01-069	.34	1.00
Sodium chloride (iodized)		.50	.50
Trace mineral premix[a]		.10	.05
Vitamin-antibiotic premix[b]		1.00	1.00
Total		100.00	100.00
Protein, %		18	15

[a]Contributed the following in mg/kg of starter/growing-finishing diet: Zn, 200/100; Fe, 100/50; Mn, 55/27.5; Cu, 10/5; Co, 1.0/.5; I, 1.5/.75.

[b]Contributed the following per kg of diet: vitamin A, 3,300 IU, vitamin D, 440 ICU, riboflavin, 2.2 mg, pantothenic acid, 13.2 mg; niacin, 17.6 mg; choline chloride, 110.0 mg; vitamin B_{12}, 2.2 mg; menadione sodium bisulfite, 2.2 mg; vitamin E, 22.0 IU; ASP-250, .28 g, in a corn carrier.

sons were made between energy level (G_c, *vs* G_t, G_{cs}) and source (G_t *vs* G_{cs}). Covariate analysis (Snedecor, 1967) was utilized on lactation data (tables 4 and 5) using number of pigs born alive as the covariate. An appropriate application of factorial analysis of variance was used for milk fat content and postweaning data. Method of sampling pigs from each litter was such that initial weight failed to equilibrate among treatments in the growth trial, therefore, initial weight was used as a covariate and ADG, ADFI and F/G values were adjusted accordingly.

RESULTS AND DISCUSSION

Effects of the dam's gestation-lactation diet on feed intake and lactation weight change of the dam and piglet number and weight at birth through 14 days are summarized in table 4. No significant gestation × lactation interaction existed for the trials reported herein thus allowing summation across the main effects (i.e., gestation and lactation). Feed intake during the lactation period averaged approximately 4.6 kg/day but was not consistent among treatments. Energy source comparisons showed that feeding tallow (G_t) during the gestation period decreased ($P<.01$) lactation feed intake in comparison to dams receiving an equal amount of ME largely in the form of carbohydrate (G_{cs}). Dams in the G_t group consumed 4.40 kg/day whereas those in the G_{cs} group consumed 4.96 kg/day. As a result of decreased lactation feed intake, sows in the G_t group lost 2.28 kg in comparison to .16 kg for those in the G_{cs} group, but the differences were not statistically significant ($P>.05$). Dams that received diet L_c consumed 4.98 kg of diet/day which was higher ($P<.01$) than L_t counterparts that consumed 4.28 kg/day. Differences in lactation weight change were not significant for the two lactation dietary treatments. Daily caloric intake for dams receiving diets L_c and L_t were 15.1 mcal and 16.4 mcal, respectively.

Dams receiving diet G_t farrowed 9.28 live piglets/litter which was higher ($P<.01$) than dams receiving diet G_{cs} (6.98) but this was probably an artifact and perhaps cannot be attributed to dietary treatment, as the number of stillborn and mummified piglets was comparable between treatments. In addition, dietary treatments were not initiated until day 100 of gestation. The fact that this apparent random difference exists makes it difficult to interpret the data. The number of piglets/litter at 14 days of age was not different between these two treatments.

The number of piglets born alive was used as a covariate for lactation data to provide clarity

TABLE 4. EFFECT OF THE DAM'S GESTATION-LACTATION DIET ON FEED INTAKE AND LACTATION WEIGHT CHANGE OF THE DAM AND PIGLET NUMBER AND WEIGHT AT BIRTH THROUGH 14 DAYS TRIALS 1 AND 2[a,b]

	Treatment[c]				
	Gestation			Lactation[d]	
Item	G_c	G_t	G_{cs}	L_c	L_t
Dam					
No. litters	30	22	22	38	36
Lactation feed intake, kg/day[e,f]	4.56	4.40	4.96	4.98	4.28
Lactation weight change, kg	-.79	-2.28	-.16	-1.70	-.45
Piglets					
No. live piglets/litter, birth[e]	8.58	9.28	6.98	...	...
No. live piglets/litter, 7 days	7.33	6.71	5.76	6.67	6.81
No. live piglets/litter, 14 days	7.15	6.64	5.71	6.55	6.71
Birth weight, kg[e]	1.36	1.17	1.51	1.40	1.31
7-day weight, kg[e]	2.43	2.19	2.66	2.51	2.36
14-day weight, kg[e]	3.82	3.45	4.29	3.92	3.80

[a]Least square means.

[b]Gilt and sow litters combined

[c]Gestation diets initiated on day 100 and maintained on respective diets until parturition. Lactation treatments were initiated immediately following parturition and maintained on treatment until day 14.

[d]Dam and piglet means adjusted for equal number piglets born alive (8.32) using covariate analysis.

[e]G_t *vs* G_{cs} significant $P<.01$.

[f]L_c *vs* L_t significant $P<.01$.

for easier and presumably more accurate interpretation of the data since dams randomly assigned treatment L_c had 8.8 pigs/litter in comparison to 7.8 for those receiving diet L_t. The number of piglets/litter at the end of 14 days was 6.71 for the L_t group which was higher but not different ($P>.05$) than 6.55 for the L_c group. In addition, piglets in the L_c and L_t group gained approximately 2.50 kg from birth to 14 days which was consistent between the treatment groups.

A significant ($P<.01$) difference in piglet birth weight as well as 7 and 14 day weight existed between gestation groups G_t and G_{cs}, however, the observed difference was probably a reflection of the difference observed at birth.

A summary of the effect of the dam's gestation-lactation diet on rate of piglet survival is presented in table 5. Piglets in the G_t group tended to have a lower (72.7%) but not significantly different rate of survival than piglets in either the G_c (83.0%) or G_{cs} (83.2%) group. Piglets in the L_t group had a higher (81.6%) but not significantly different rate of survival than piglets in the L_c group (79.2%). Administration of this level of tallow to the dam prior to parturition appeared to exert a negative influence upon piglet survival, but addition of tallow immediately following parturition may have a positive effect. Cast *et al.* (1977) reported that tallow, added at the rate of 15% of the diet from day 109 of gestation through lactation, increased ($P<.05$) piglet survival.

Survival rate was compared on days 1, 2, 3, 7 and 14 for piglets weighing $\leq$1,000 g at birth. At the conclusion of day 1, survival rate among piglets whose dams had received tallow in their lactation diet was higher (86.5%) compared to those in the L_c group (80.5%). The difference was not significant. However, it was observed that addition of tallow did significantly increase ($P<.10$) survival rate of the smaller less competitive piglets by day 2. By the conclusion of day 2, 64.1% of the piglets in the L_c group survived, whereas 82.2% of those in the L_t group remained. Rate of piglet survival, on day 14, was 43.4% and 53.4% for L_c and L_t treatments respectively. Addition of tallow to the diet of the lactating dam appeared to exert a positive response in survival of small ($\leq$1,000 g) piglets. A similar response was also observed by Cast *et al.* (1977) in pigs $\leq$1,090 g at birth.

TABLE 5. EFFECT OF THE DAM'S GESTATION-LACTATION DIET ON RATE OF PIGLET SURVIVAL, TRIALS 1 AND 2[a,b]

Item	Treatment				
	Gestation			Lactation	
	G_c	G_t	G_{cs}	L_c	L_t
All piglets					
No. litters	30	22	22	38	36
% alive through day 14[c]	83.0	72.7	83.2	79.2	81.6
Piglets weighing ⩽ 1,000 g at birth[d]					
% of total piglets (all litters)[e]	11.5	34.0	10.2	17.0	20.1
% of total piglets (litters with pigs ⩽ 1,000 g)[f]	21.9	42.9	22.2	30.6	28.1
% alive through day 1[f]	83.5	87.8	65.5	80.5	86.5
% alive through day 2[f,g]	73.1	75.2	64.1	64.1	82.2
% alive through day 3[f]	52.6	62.3	63.7	59.4	69.7
% alive through day 7[f]	47.8	48.6	54.3	55.9	55.5
% alive through day 14[f,h]	33.5	42.9	53.7	43.4	53.4

[a]Least square means.

[b]Gilt and sow litters combined.

[c]Means for lactation data adjusted by covariate analysis for equal number of piglets born alive/litter (L_c, 8.8; L_t, 7.8). Unadjusted values for L_c and L_t respectively: 78.4, 80.9.

[d]Number of litters with piglets weighing ⩽ 1,000 g at birth: G_c, 16; G_t, 16; G_{cs}, 9; L_c, 18; L_t, 23.

[e]G_t *vs* G_{cs} significant $P<.10$.

[f]Means for lactation data adjusted by covariate analysis for equal number of piglets born alive/litter (L_c, 10.1; L_t, 8.9). Unadjusted means for L_c and L_t on days 1, 2, 3, 7 and 14 respectively are: 78.0, 87.2; 61.4, 84.4; 55.8, 77.3; 49.4, 65.4; 40.9, 63.5.

[g]L_c *vs* L_t significant $P<.10$.

[h]G_c *vs* G_t, G_{cs} significant $P<.10$.

Addition of tallow to the diet during the gestation period increased the proportion of piglets weighing ⩽1,000 g in the G_t group in comparison with the G_{cs} group (34.0% *vs* 10.2%; $P<.10$) an observation which is difficult to interpret due to extreme differences in the mean number of piglets born alive/litter for the respective treatments. Survival rate of piglets between gestation treatments in the ⩽1,000 g class was not different except on day 14 when a significant ($P<.10$) difference between energy level was observed (G_c, 33.5% *vs* G_t, 42.9% and G_{cs}, 53.6%).

It is apparent from the reports of Hutchinson *et al.* (1954), Pomeroy (1960), Baumann *et al.* (1966) and Fahmy and Bernard (1971) that the most critical period for piglet survival is during the first 3 days of postnatal life. Death occurs predominantly in smaller pigs in the litter (Pomeroy, 1960; Fahmy and Bernard, 1971), which could be indicative of an inability to effectively compete with larger littermates for nourishment from the dam.

Addition of tallow to the diet of gilts during the gestation period increased fat content of colostrum (table 6) in comparison to those receiving diets G_c or G_{cs} (8.9% *vs* 6.8%, 5.6%, respectively) but this increase was not sustained as determined from subsequent milkings. Period means for gilts receiving diets G_c, G_t, G_{cs} were 8.6, 9.5 and 9.2, respectively, with a significant difference existing between energy levels ($P<.10$). This would tend to indicate that additional energy, in the form of either tallow or cornstarch late in gestation, promotes an increased concentration of milk fat. Although fat content increased for the period, the magnitude was small.

Administration of tallow following parturition increased percent milk fat ($P<.01$) for the lactation period in comparison to dams receiving the control diet (10.0% *vs* 8.1%, respectively). The mean values on days 7, 14 and 21 show the same trend. A gestation × lactation interaction ($P<.01$) existed which demonstrates that addition of tallow to lactation diets of gilts pre-

TABLE 6. EFFECT OF GESTATION AND LACTATION DIET ON FAT CONTENT OF COLOSTRUM AND MILK IN GILTS, TRIAL 2[a]

	Dietary treatment				
	Gestation[b,c]			Lactation[d]	
Item	G_c	G_t	G_{cs}	L_c	L_t
No. gilts	7	6	4	9	8
Day, % fat					
1	6.77	8.94	5.57	7.63	6.59
7	9.63	9.64	11.95	9.16	11.69
14	9.05	9.38	9.67	8.37	10.60
21	9.20	8.53	9.61	7.50	10.75
Period[e]	8.58	9.46	9.20	8.10	10.04

[a]Least square means.

[b]Gestation X day interaction significant (P<.01).

[c]Gestation X lactation interaction significant (P<.01) for the period: G_c-L_c, 7.27 *vs* G_c-L_t, 9.85; G_t-L_c, 9.30 *vs* G_t-L_t, 9.71; G_{cs}-L_c, 7.83 *vs* G_{cs}-L_t, 10.57.

[d]Lactation X day interaction significant (P< .01).

[e]G_c *vs* G_t, G_{cs} significant (P<.10); L_c *vs* L_t significant (P<.01).

viously receiving G_c or G_{cs} promoted an increase in milk fat content of approximately 2.5-3.0% in comparison to the L_c counterpart (table 6, footnote c). Addition of tallow to the lactation diet of sows receiving diet G_t increased milk fat content only slightly (.4%).

An important observation is that addition of tallow prior to parturition helps to buffer against a large difference in milk fat content between day 1 and 7. This finding is in harmony with data by Seerley *et al.* (1974) and Friend (1974), both of which added corn oil to diets of sows prior to parturition. The increase in percent milk fat occurring as a result of adding tallow to diets during lactation may have been a major factor contributing to increased piglet survival.

A summary of the long term effect(s) of the dam's gestation and lactation diet upon subsequent performance of piglets during the growing-finishing phase is presented in table 7. Average daily feed intake was approximately 1.88 kg/day while ADG averaged .60 kg/day. Both were similar among treatments. The F/G ratio

TABLE 7. LONG TERM EFFECT OF GESTATION AND LACTATION DIETS UPON SUBSEQUENT PERFORMANCE OF PIGLETS DURING THE GROWING-FINISHING PHASE, TRIAL 2[a]

	Treatment				
	Gestation[b]			Lactation[c]	
Item	G_c	G_t	G_{cs}	L_c	L_t
Total number	34	34	32	54	46
Initial weight, kg	5.14	5.51	6.86	6.01	5.67
Feed intake, kg/day	1.88	1.88	1.89	1.88	1.89
Gain, kg/day	.59	.60	.62	.60	.60
Feed efficiency, F/G	3.20	3.11	3.06	3.12	3.14

[a]Mean values for feed intake, gain and feed efficiency are adjusted for initial weight.

[b]4 replications per treatment.

[c]6 replications per treatment.

TABLE 8. STANDARD ERROR OF TREATMENT MEANS FOR VARIOUS PARAMETERS, TRIALS 1 AND 2

Response criteria	Standard error of treatment means[a]				
	Gestation			Lactation	
	G_c	G_t	G_{cs}	L_c	L_t
Dam:					
Feed intake, kg/day	.31 (30)	.36 (22)	.36 (22)	.27 (38)	.28 (36)
Weight change, kg	2.94 (30)	3.43 (22)	3.43 (22)	2.61 (38)	2.69 (36)
Milk fat content (period), %	.26 (28)	.28 (24)	.34 (16)	.23 (36)	.24 (32)
Piglets[b]:					
No. live/litter, birth	.45 (30)	.53 (22)	.53 (22)	.40 (38)	.41 (36)
No. live/litter, 14 days	.46 (30)	.53 (22)	.53 (22)	.40 (38)	.41 (36)
Birth weight, kg	.09 (30)	.11 (22)	.11 (22)	.08 (38)	.08 (36)
14 day weight, kg	.31 (30)	.36 (22)	.36 (22)	.27 (38)	.28 (36)
14 day survival, %	3.58 (30)	4.18 (22)	4.18 (22)	3.18 (38)	3.27 (36)
14 day survival ($\leq$ 1,000 g), %	8.56 (16)	8.56 (16)	11.41 (9)	8.05 (18)	7.12 (23)
Growing-finishing pigs[c]:					
Gain, kg/day	.01 (4)	.01 (4)	.01 (4)	.01 (6)	.01 (6)
Feed intake, kg/day	.09 (4)	.09 (4)	.09 (4)	.07 (6)	.07 (6)
Feed efficiency, F/6	.08 (4)	.08 (4)	.08 (4)	.06 (6)	.06 (6)

[a]Number of replications appears in parenthesis.

[b]Experimental unit is the litter.

[c]Experimental unit is a pen with each containing 8 to 9 pigs.

tended to favor administration of an increased metabolizable energy level to the dam during the gestation period but the numerical difference was not significantly different (3.20 *vs* 3.11, 3.06). The F/G ratio averaged approximately 3.13 for piglets whose dams received either diet L_c or L_t. Administration of an increased energy level or source to the dam during the gestation-lactation period exerted no long term effects on the offspring in terms of gain and feed efficiency. Friend (1974) reported that piglets whose dams had received a diet containing 10% corn oil in comparison to 10% cornstarch for a brief period to parturition and throughout a 35-day lactation were more efficient in feed utilization. The degree of variation associated with each trait is provided in tabular form in table 8.

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