EFFECTS OF EARLY WEANING OF PIGS TO A DRY OR LIQUID MILK DIET ON SUBSEQUENT GROWTH AND CARCASS MEASUREMENTS

By

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SUMMARY

Forty-five Yorkshire baby pigs from five litters (9 pigs from each litter and with mean body weight 1.9kg), at two days of age were randomly, within litter, left with the sow to 21 days of age (treatment 1), weaned to a 24% protein dry diet fed *ad libitum* (treatment 2), or to homogenized cow milk fed in restricted amounts four times daily to 21 days of age (treatment 3).

From day 22, all pigs were fed a corn-soybean meal type diet containing 18% protein to 10 weeks of age, and a similar diet containing 16% protein from 10 weeks of age to slaughter at approximately 160 days.

Average daily weight gain (ADG) and live body weight at slaughter were significantly lower, and feed/gain significantly higher among cow milk-fed pigs (treatment 3) than among pigs left with the sow until 3 weeks (treatment 1) and pigs weaned to dry diet (treatment 2).

Backfat thickness, loin eye area, yield of lean cuts and dressing percent did not differ significantly among treatments. The results confirmed that weaning at two to three days to a dry diet fed *ad libitum* or to cow milk fed in restricted amounts four times daily is feasible, but overall performance from birth to slaughter of pigs weaned to a dry diet at two days of age was similar to that of pigs weaned at three weeks of age and superior to that of pigs weaned to cow milk at two days of age.

INTRODUCTION

Sow productivity can be assessed by the number of pigs weaned per sow per year, and the age of weaning can greatly influence sow productivity by its effect on the farrowing interval (Newport, 1977). Artificial rearing of early weaned pigs reduces the high early post-natal mortality through the control of environment (Braude *et al.*, 1970) and by preventing overlaying or crippling by the sow.

Pigs have been weaned both to liquid diets (Busted *et al.*, 1948; Young and Underdahl, 1953; Braude *et al.*, 1970) and dry diets (Menge and Frobish, 1976).

Although the best age to early-wean has not been established, pigs have been successfully weaned at fourteen days (Ewan, 1970), ten days (Lucas *et al.*, 1959), seven days (Hartman *et al.*, 1961), two days (Smith and Lucas, 1957; Menge and Frobish, 1976; Benson *et al.* (1977) and at birth (Lecce, 1969).

The present study was designed to determine the effect of three weaning systems on overall performance and carcass measurements of pigs at market weight.

MATERIALS AND METHODS

Forty-five Yorkshire baby pigs from five litters (9 pigs each), with an average initial weight of 1.9kg were used. In each litter, all pigs, nursed their dams for two days to assure adequate colostrum intake. Each pig was subjected to normal husbandry practices, and received 150mg of iron dextran intramuscularly at two days of age.

On day two, pigs in each litter were randomly (3 pigs per group) assigned to one of the 3 treatment groups: left with the sow (treatment 1); weaned to a 24% protein diet (table 1), (treatment 2); or weaned to liquid cow milk (treatment 3). Pigs remained on these treatments until 21 days of age.

Pigs left with the sow until three weeks of age (treatment 1) nursed the sow, but were not creep-fed. Pigs removed from the sow at two days of age (treatments 2 and 3) were housed individual wire-floored metal cages equipped with an

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TABLE 1:

Percentage Composition of Diets

Ingredients	Int. Ref. Number	Diets		
		Early Weaning Diet	Normal Wean- ing Diet	Finisher Diet (a,b) ¹
Yellow maize	4-05-005	11.0	71.7	76.9
Soybean meal	5-04-612	31.0	23.0	18.0
Dried skim milk	5-01-275	30.0	0.0	0.0
Glucose monohydrate		20.2	0.0	0.0
Corn oil		4.0	0.0	0.0
Trace mineralized salt		0.5	0.5	0.5
Vitamin Supplements				
(a) Hopro—R		0.5	0.5	0.5
(b) Crystalline		0.5	0.0	0.0
Dicalcium phosphate	6-01-080	1.8	2.5	2.5
Ground limestone	6-02-632	0.0	1.5	1.5
Antibiotic supplement: Aureo SP—250 ²		0.5	0.3	0.3
Total		100.0	100.0	100.0
% Protein:				
(calculated)		24.0	18.0	16.0
(from analysis)		27.0	17.0	15.0

- (a) Finisher diet with antibiotics; (b) Finisher diet with no antibiotics
- Supplied penicillin (from Procaine Pencillin) .11/g/kg; Sulmet Sulfamethazine, .2g/kg; Aureomycine (chlortetracycline) 2. g/kg, of diet.

electric heating device with thermostat to maintain 35°C condition. Pigs in treatment 2 were fed a transition diet (mixture of the cow milk and the dry diet progressively altered in ratio from 80 milk, 20 dry diet at the first feeding, through 50:50 by the 4th feeding and 20:80 by the 6th feeding) for the first two days. Semi-liquid in consistency and acceptable to the pigs, this transition diet quickly habituated the pigs to the dry diet, thus solving the problem (Braude *et al* 1970) usually encountered in switching early weaned pigs to dry diets. The 24% protein dry diet was thereafter fed *ad libitum* in

porcelain bowls. Drinking water was continuously available.

Homogenized vitamin D-fortified cow milk was fed to pigs in treatment 3 four times daily. Quantity of milk fed per feeding was limited to a volume completely consumed within 5 to 10 minutes to avoid possible microbial infection from left-over milk. Thus, the pigs received 40 ml. of milk at first feeding, and a 10 ml. increase per subsequent feeding until a maximum of 130 ml. was attained, and continued at that level until day 21.

On day 21, pigs left with the sow (treatment 1) were weaned and those in

treatments 2 and 3 were removed from the cages. Using closeness of body weights as the only criterion, pigs were randomly assigned in pairs or trios to concrete-floored pens and fed *ad libitum*, an 18% protein corn-soybean meal diet (table 1) from wooden self-feeders. Drinking water was available from an automatic drinking fountain in each pen.

At 10 weeks, pigs were changed to a 16% protein diet (table 1). As pigs reached approximately 80 kg. body weight or approximately 150 days of age, they were fed the same 16% protein diet but without antibiotics, to ensure at least 7 days withdrawal from antibiotics before slaughter at approximately 160 days of age (Pond and Maner, 1974).

Average body weight gain (ADG) until slaughter, feed intake, feed/gain and carcass measurements of the pigs at slaughter (backfat thickness, carcass length, loin eye area and percent lean cuts) were subjected to analysis of variance (Steel and Torrie, 1960; Snedecor and Cochran, 1970).

RESULTS AND DISCUSSION

Feed/gain (table 2) for pigs left with the sows until 3 weeks of age (treatment 1)

was significantly ($P < .05$) lower from 3 to 23 weeks of age than for cow milk fed pigs (treatment 3) but was not significantly lower for pigs weaned to dry diet (treatment 2). Average daily weight gain (ADG) from 3 days to 10 weeks (table 3) was significantly ($P < .05$) higher for sow reared pigs than for both groups of early weaned pigs. However, ADG for pigs left with the sow until 3 weeks (treatment 1), from 3 days to 23 weeks (slaughter), exceeded ADG of milk-fed pigs (Group 3), but not of pigs weaned to a dry diet (treatment 2). By the sixth week, the pigs weaned to cow milk at 2 days (treatment 3 pigs) weighed approximately 60% of the body weights of their sow reared or dry diet fed littermates. Growth curves for each group of pigs are shown in Figure 1. The values for ADG and feed/gain in this report agree with those of Menge and Frobish (1976) who found no significant difference in total gains for 3 weeks between pigs weaned after 2 days of colostrum intake to a dry diet and pigs reared conventionally with the sow. The importance of colostrum for the survival of the neonatal pig has earlier been documented (Dyrendahl *et al.*, 1953; Lecce and Matrone, 1960; Coalson and Lecce, 1973; Wilson,

TABLE 2

Effects of Three Weaning Systems on Daily Feed intake and Feed Efficiency of Pigs

Treatment	Weaned at 3 weeks	Weaned to dry diet at 2—3 days	Cow milk to 3 weeks	SD
Group No.	1	2	3	
Age	Average Daily Feed Intake (Kg/day)			
3—23 weeks	1.92 ^a	1.77 ^a	1.66 ^a	0.16
10—23 weeks	2.42 ^a	2.30 ^a	2.19 ^a	0.17
	Feed Efficiency (Feed/Gain)			
3—32 weeks	2.99 ^a	3.07 ^a	3.72 ^b	0.41
10—23 weeks	3.17 ^a	3.22 ^a	3.60 ^a	0.39

ab: Means in the same horizontal line without a common superscript are significantly different ($P < .05$).

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TABLE 3

Effects of Three Weaning Systems of Average Daily Weight Gains of Pigs

Treatment	Weaned at 3 weeks	Weaned to dry diet at 2—3 days	Cow milk to 3 weeks	SD
GROUP NO.	1	2	3	
Age	Average Daily Weight Gain (g/day)			
No of pigs	15	14	14	
3—24 weeks	340.9 ^a	274.94 ^a	167.8 ^b	37.12
3 days to 23 weeks	756 ^a	513 ^a	426 ^a	40.19

ab: Means in the same horizontal line without a common superscript are significantly different ($P \leq 0.5$).

1974). Proteins from other sources other than milk have been used in early pig rearing (Braude *et al.*, 1970; Pettigrew and Harmon, 1977; Pettigrew *et al.*, 1977), but milk proteins have been shown to be superior to both soybean proteins (Pond *et al.*, 1971) and egg-white protein (Pettigrew and Harmon, 1977) for artificial rearing of pigs 1 to 2 days of age. This superiority of milk proteins over other protein sources for baby pigs may be due to the presence in the baby pigs of digestive enzyme specificity for milk but not for other protein sources, or to the antibody activity of milk immunoglobulins (Wilson, 1974; Pettigrew and Harmon, 1977). The significantly lower daily weight gains of milk-fed pigs in this experiment was probably due to their lower caloric intake from 3 days to 3 weeks of age. The total dry matter intake per milk-fed pig during this three week period was only 1182 grams. Although dry feed intake of pigs in treatment 2 was not measured due to unknown amounts of feed spillage, and sow milk consumption of pigs that nursed their dams for 3 weeks (treatment 1) was not known, average dry matter intake in previous reports (Braude *et al.*, 1970; Menge and Frobish, 1976) suggests that they dry matter intake of pigs fed cow milk in the present study was considerably less than that of other groups. However, ADG of pigs in this

study exceeded values reported by other investigators for pigs in comparable situations. Suckled pigs have been reported to gain 170 to 250 g/day while artificially reared, early weaned and dry diet fed pigs gained 217 to 272 g/day (Braude *et al.*, 1970; Jones, 1972); and milk-fed pigs 44 to 69 g/day (Pond *et al.*, 1971). In this study, pigs left with sow until 3 weeks (treatment 1 pigs) gained 340.19 g/day, pigs weaned to dry diet gained 274.94 g/day while milk-fed pigs gained 167.8 g/day. The results confirm those of early preliminary work (Benson, *et al.*, 1977), in which performance to six weeks of age of pigs weaned at 2 days to the same dry diet used in this study was superior to that of pigs fed cow milk to 3 weeks of age.

The mean carcass measurements of the pigs are shown in table 4. Treatment had no significant effect on average dressing percent, backfat thickness, loin eye area, percent of lean cuts (weight of wholesale cuts of each pig expressed as percentage of carcass weight) and yield of lean cuts. Values for carcass length were significantly ($P < .05$) lower in milk-fed pigs than in both the pigs left with the sow and pigs weaned to dry diet, between which carcass length did not differ. The lower values for carcass length among milk-fed pigs may also have been due to their lower caloric intake in the first 3 weeks of life, which generally slowed down their carcass

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TABLE 4

Effects of Three Weaning Systems on Carcass Measurements

Treatments	Weaned at 3 weeks	Weaned to dry diet at 2—3 days	Cow milk to 3 weeks	SD
GROUP NO.	1	2	3	
Average slaughter wt. (kg)	81.2	74.3	61.6	4.20
" Carcass wt. (kg)	68.0	61.9	52.1	3.90
" Backfat (cm)	2.9	3.2	2.8	0.32
" Length (cm)	77.7	77.7	75.7	1.65
" Loin eye Area (cm ²)	29.0	27.4	26.4	0.38
" Dressing Percent	73.5	73.7	73.9	1.11
" Boston Bult	5.0	5.0	5.4	0.34
" Picnic	6.9	6.8	6.8	0.30
" Ham	15.3	14.7	15.1	0.41
" Loin	12.4	12.8	12.4	1.09
" Yield of Lean Cuts	39.6	39.6	39.7	1.45

development in later life. Lodge *et al.*, (1977), had earlier showed that feed restriction in early life reduced cell division without affecting, cell size, and that increase in cell division during subsequent *ad libitum* feeding did not result in compensatory growth.

CONCLUSION

In this study, pigs weaned to a specially formulated dry diet at two days of age and fed *ad libitum* until slaughter, performed similarly during the later one-half of the growth period to pigs weaned from the sow at 3 weeks of age, both of which were superior to pigs weaned to and fed cow milk to 3 weeks. This study confirms the superiority of specially formulated dry diet fed *ad libitum* over a liquid diet fed in restricted amounts in promoting aptimal performance of early weaned pigs to slaughter weight (Menge and Frobish, 1976). This study further points to the possibility of using early weaning of pigs

to specially formulated dry diets as a method of both increasing sow productivity per year through decreasing her farrowing interval, as well as successfully rearing orphan pigs.

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