EFFECTS OF SUBSTITUTING YEAST PROTEIN FOR SOY PROTEIN ON GAIN, FEED EFFICIENCY AND INCIDENCE OF SCOURS IN EARLY WEANED PIGS

T.M. Fakler[1], K.S. Sohn[2] and C.V. Maxwell[3]

Story in Brief

A study involving sixty-six Yorkshire pigs (six each from 11 liters) was conducted to determine the effect of substituting yeast protein for soy protein in prestarter and starter diets. Pigs were weaned at approximately 21 days of age and randomly allotted within litter to six treatments. From day 1 to day 14 (Period 1), a complex prestarter diet (Positive control), a standard corn-soybean meal prestarter diet (Negative control) and four diets containing increasing levels of yeast protein were fed. From day 15 to day 35 (Period 2), pigs were fed a lower lysine (1.1%), less complex starter diet. Fecal consistency was subjectively evaluated at 2-day intervals by three independent evaluators during weeks 1 and 2 and at the end of weeks 3, 4 and 5, with an increasing fluidity of the stool corresponding to an increased score. Fecal samples were obtained and dry matter content determined at the end of weeks 1, 2 and 4. Increasing levels of dietary yeast at the expense of soy protein did not significantly affect average daily gain, average daily feed intake or feed efficiency during any time period. A linear increase in fecal evaluation scores was observed in pigs fed increasing levels of yeast protein (treatments 2 through 6) for days 8, 10, 12, 14 and 21. However, a linear decrease in fecal dry matter was observed only during week 1 in pigs fed increasing levels of yeast protein. Performance characteristics were similar for pigs fed the yeast protein diets and the complex industry standard diets (Positive control). These findings indicate that yeast protein can be substituted for soy protein in prestarter and starter swine diets without loss in performance.

(Key Words: Early Weaned Pig, Protein Source, Yeast Protein.)

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[1]Graduate Assistant [2]Research Associate [3]Professor

Introduction

The practice of early weaning pigs (18 to 21 days of age) is considered essential in modern pork production in order to maximize profits by shortening the breeding cycle and maximizing reproductive efficiency of the sow. One of the major problems with the practice of early weaning is the observed postweaning lag which lasts from 5 to 10 days and is characterized by low feed intake, little or no gain, diarrhea and increased mortality rates. It has been suggested that nutritional factors may also influence postweaning performance in early weaned pigs (Li et al., 1990).

Although the young pig can utilize a simple corn-soybean diet when weaned as early as 18 days of age, performance is improved by incorporating alternative sources of protein into the diet (Dietz et al., 1988). Increased usage of milk products, particularly dried skim milk and dried whey, has been shown to increase performance of early weaned pigs. Availability of large surpluses encouraged the use of these milk products as subsidized, low price by-products were a part of worldwide dairy product surpluses. More recently, these surpluses have diminished as a result of decreased incentives and subsidies. In addition, rapid advances in processing technology have changed the type of milk by-products available.

Protein sources which have the potential of replacing the more expensive milk proteins or the soy proteins in early weaned pig diets should be readily accepted by the swine industry. This study was conducted to determine the effects of substituting yeast proteins for soybean meal in prestarter and starter diets and to compare performance of pigs fed the yeast protein diets with performance of pigs fed a complex diet formulated to meet typical industry standards.

Materials and Methods

Sixty-six Yorkshire pigs (six each from 11 litters) were weaned at 20 to 22 days of age and allotted by sex and weight within litter to one of six dietary treatments providing a total of eleven pigs per treatment. During the first 14 days, pigs were assigned to one of six dietary treatments (Table 1): 1) control diet formulated to meet industry standards (Positive control); 2) standard corn-soybean meal prestarter diet (Negative control); 3, 4, 5 and 6) replaced

Table 1. Composition[a] of diets fed during period 1.

Ingredient	Positive control	Negative control	Provesteen-T 25%	Provesteen-T 50%	Provesteen-T 75%	Provesteen-T 100%
Corn	46.56	61.44	62.20	63.13	62.99	63.55
SBM, 50%	12.00	30.00	22.60	14.90	7.50	----
DSM	10.00	----	----	----	----	----
Whey	20.00	----	----	----	----	----
Fish meal	5.00	----	----	----	----	----
Provesteen-T	----	----	7.05	14.00	21.18	28.00
Fat	4.00	4.00	4.00	4.00	4.00	4.00
Lys	.17	.24	.24	.24	.24	.24
Apralan	.10	.10	.10	.10	.10	.10
$CaCO_3$	.42	1.03	1.76	2.19	2.48	2.54
Dical	.51	1.85	.66	----	----	----
Vit. TM	.94	.94	.94	.94	.94	.94
Salt	.30	.40	.40	.40	.40	.40
Met	----	----	.05	.10	.15	.20
Trp	----	----	----	----	.02	.03
Calculated composition of diet						
ME (Mcal/lb)	1.56	1.56	1.56	1.56	1.55	1.54
Lys (%)	1.30	1.30	1.30	1.30	1.30	1.30
CP (%)	19.10	19.77	20.15	20.33	20.72	20.91
Thr (%)	.86	.79	.82	.85	.88	.90
Trp (%)	.24	.26	.24	.23	.23	.23
Met + Cys (%)	.70	.67	.67	.67	.67	.67
Ca (%)	.90	.90	.90	.90	1.00	1.00
P (%)	.70	.70	.70	.79	1.01	1.21

[a] As fed basis.

soy protein with dried yeast protein[4] at levels of 25, 50, 75 and 100% respectively, on an equal lysine basis (1.3%). For days 15 to 35 (Period 2), diets were reformulated to a lower lysine (1.1%), less complex starter diet (Table 2). Pigs were housed in individual, elevated metal pens in an environmentally controlled room with ad libitum access to feed and water. Interim gain and efficiency estimates were obtained weekly. Fecal samples

Table 2. Composition[a] of diets fed during period 2.

Ingredient	Positive control	Negative control	Provesteen-T 25%	50%	75%	100%
Corn	60.13	68.73	70.13	71.51	72.31	73.28
SBM, 44%	20.00	27.40	20.50	13.60	6.80	----
Whey	10.00	----	----	----	----	----
Fish meal	3.00	----	----	----	----	----
Provesteen-T	----	----	5.81	11.62	17.42	23.00
Fat	4.00	----	----	----	----	----
Lys	.17	.17	.17	.17	.17	.17
Apralan	.10	.10	.10	.10	.10	.10
$CaCO_3$	.62	.92	1.52	2.05	2.21	2.40
Dical	1.30	1.80	.86	----	----	----
Vit. TM	.38	.38	.38	.38	.38	.38
Salt	.30	.50	.50	.50	.50	.50
Met	----	----	.03	.06	.09	.13
Trp	----	----	----	.01	.02	.04
ME (Mcal/lb)	1.55	1.47	1.48	1.49	1.49	1.49
Lys (%)	1.10	1.10	1.10	1.10	1.10	1.10
CP (%)	17.08	17.90	18.19	18.49	18.77	18.95
Thr (%)	.72	.71	.74	.77	.79	.82
Trp (%)	.22	.24	.22	.22	.22	.22
Met + Cys (%)	.60	.60	.60	.60	.60	.60
Ca (%)	.85	.85	.85	.85	.89	.95
P (%)	.70	.70	.70	.72	.89	1.06

[a] As fed basis.

[4] Provesteen[R]T, Provesta Corporation, Bartlesville, OK

were obtained and dry matter content determined at the end of weeks 1, 2 and 4. Fecal consistency was subjectively evaluated at 2-day intervals by three independent evaluators during weeks 1 and 2 and at the end of weeks 3, 4 and 5. Each fecal sample was scored 1, 2, 3, 4 or 5 corresponding to evaluations of firm, moderately form, moderately watery, watery and extremely watery respectively.

The data for each response criteria were analyzed by least squares analysis of variance with treatment, litter, sex and appropriate 2-way interactions in the model. Orthogonal contrasts were used to compare linear, quadratic and cubic response to level of Provesteen in the diet (Negative control to 100%). Dunnett's test for comparisons with controls was used to separate means for characteristics in which differences were significant.

Results and Discussion

The effect of protein source on average daily gain is presented in Table 3. During all weeks and within all periods, pigs fed the yeast protein diets grew as fast as pigs fed the corn-soy diet and the complex positive control diet. In addition, during week 5, average daily gain increased with increasing level of yeast protein ($P < .06$).

Average daily feed intake (Table 4) and feed efficiency values (Table 5) were similar during all weeks and within all periods. It is interesting to note however, that though not statistically significant, the efficiency of feed

Table 3. Least squares means for average daily gain (lb).

			Provesteen-T			
Period	Positive control	Negative control	25%	50%	75%	100%
Period 1	.58	.49	.55	.52	.55	.55
Week 1	.40	.29	.31	.27	.34	.31
Week 2	.75	.67	.79	.77	.76	.79
Period 2	1.21	1.21	1.29	1.31	1.34	1.34
Week 3	.82	.94	1.01	1.07	1.16	1.00
Week 4	1.31	1.26	1.33	1.35	1.26	1.37
Week 5[a]	1.48	1.43	1.52	1.51	1.59	1.64

[a] Linear effect ($P < .06$) for negative control through 100% diet.

Table 4. Least squares means for average daily feed intake (lb).

Period	Positive control	Negative control	Provesteen-T 25%	50%	75%	100%
Period 1	.83	.75	.75	.76	.73	.73
Week 1	.56	.51	.49	.48	.51	.45
Week 2	1.10	.99	1.02	1.03	.95	1.00
Period 2	2.08	2.04	2.17	2.21	2.22	2.08
Week 3	1.62	1.58	1.72	1.82	1.79	1.62
Week 4	1.93	1.96	2.18	2.14	2.04	2.06
Week 5	2.71	2.59	2.62	2.68	2.84	2.57

Table 5. Least squares means for feed efficiency (Gain/Feed).

Period	Positive control	Negative control	Provesteen-T 25%	50%	75%	100%
Period 1	.702	.631	.762	.699	.619	.734
Week 1	.696	.586	.726	.603	.591	.629
Week 2	.709	.675	.798	.794	.646	.839
Period 2	.489	.583	.653	.640	.671	.575
Week 3	.684	.617	.671	.668	.601	.669
Week 4	.571	.513	.590	.681	.570	.621
Week 5	.581	.571	.638	.663	.614	.622

utilization during week 5 and period 2 was improved with the feeding of the yeast protein.

Fecal dry matter values on day 7 (Table 6) for pigs fed treatments 4, 5 and 6 were lower ($P<.05$) than for pigs fed treatments 1, 2 and 3. On days 14 and 28, fecal dry matter values were similar . Fecal scores (Table 7) for days 2 through 14 did not differ. On days 21 and 28, pigs fed the 75% Provesteen-T diet had higher ($P<.05$) fecal scores than pigs fed all other diets. An increased fecal score was observed with increasing levels of yeast protein on days 8, 10, 12, 21 and 35. This linear increase, although statistically significant, was still within a reasonable range for pigs of this age.

Table 6. Least squares means for percentage fecal dry matter.

Day	Positive control	Negative control	Provesteen-T 25%	50%	75%	100%
Day 7[a]	30.0[b]	27.0[b]	29.6[b]	25.0[c]	25.6[c]	24.6[c]
Day 14	27.0	25.6	26.8	26.3	24.7	27.1
Day 28	27.8	26.8	27.6	27.0	26.2	28.6

[a] Linear Effect ($P < .05$) for negative control through 100% diet.
[b,c] Means with different superscripts differ ($P < .05$).

Table 7. Least squares means for fecal scores.

Day	Positive Control	Negative Control	Provesteen-T 25%	50%	75%	100%
Day 2	1.60	1.49	1.57	1.59	1.46	2.26
Day 4	1.93	1.79	1.80	1.66	1.87	1.73
Day 6	1.54	1.75	1.61	1.68	1.86	1.96
Day 8[a]	1.73	2.02	1.87	2.26	2.55	2.59
Day 10[a]	1.87	2.14	1.90	2.33	2.49	2.66
Day 12[ab]	1.97	2.24	1.97	2.32	2.52	2.48
Day 14	2.20	2.47	2.27	2.32	2.61	2.70
Day 21[ab]	2.17[c]	2.16[c]	2.20[c]	2.28[c]	2.67[d]	2.35[c]
Day 28	2.11[c]	2.20[c]	2.39[c]	2.33[c]	2.47[d]	2.36[c]
Day 35[e]	2.38	2.39	2.41	2.47	2.51	2.56

[a] Linear effect ($P < .01$) for negative control through 100%diet.
[b] Cubic effect ($P < .05$) for negative control through 100%diet.
[c,d] Means with different superscripts within rows differ ($P < .05$).
[e] Linear effect ($P < .06$) for negative control through 100%diet.

The search for alternate sources of protein for use in early weaned pig diets in order to increase performance and profits continues. This study indicates that the yeast protein can be effectively substituted for soy protein in prestarter and starter swine diets for early weaned pigs without loss in performance.

Literature Cited

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