EFECT OF PORCINE SOMATOTROPIN AND SEX-CLASS ON PORK CARCASS CHEMICAL COMPOSITION

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Story in Brief

Thirty hogs (15 gilts and 15 barrows) were allocated to one of five treatments receiving 0 (control), .71, 1.43, 2.86, or 4.29 mg/day of porcine somatotropin (pST). Hogs were slaughtered upon attaining an individual live weight of 230 lb. Left sides were physically separated into lean, inseparable lean, fat and bone components. Additionally, the femur and tenth rib bones were collected from each side. Proximate analysis was performed in triplicate on a subsample from each tissue aggregate and bone group. Hogs treated with 2.86 mg/day or more of somatotropin had lower levels of lipid and higher protein, moisture and ash levels than control hogs. No additional improvement in carcass chemical composition was attained by increasing pST level to 4.29 mg/day. Gilt carcasses had lower percentages of total lipid and higher percentages of protein and moisture than barrow carcasses.

(Key Words: Porcine Somatotropin, Sex Class, Carcass Composition.)

Introduction

Because of consumer concerns emphasizing a reduction in caloric intake from dietary fat, retailers and meat processors have become increasingly concerned with product fat levels. Therefore, methods of producing trimmer carcasses should be expanded to meet demand. Porcine somatotropin has been shown to reduce fat deposits when injected in finishing swine (Ivy et al., 1986). Apparently, porcine growth hormone dramatically alters nutrient partitioning to ultimately decrease lipid accumulation and increase protein synthesis in market weight hogs.

The dosage level of somatotropin for optimum efficiency has not been determined. Previously, analysis of carcass grade traits and cooking properties revealed that somatotropin treatments of 1.43 mg/day produced trimmer carcasses with no adverse effects on cooking properties when compared to non-treated controls (Gardner et al., 1989). Additional information is needed to

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further examine the impact of growth hormone on carcass chemical composition. Physical dissection accompanied by chemical analysis is considered an ideal endpoint for measurement of carcass composition (Cross, 1982). Therefore, the objective of this study was to examine the effects of porcine somatotropin, administered daily, on barrow and gilt carcass chemical composition.

Materials and Methods

Complete background information (slaughter, carcass grade and cookery data) was previously reported by Gardner et al. (1989). Briefly, 15 gilts and 15 barrows were allocated across five treatment groups and administered porcine somatotropin (pST) as follows: none (control), .71, 1.43, 2.86, and 4.29/mg/day.

Approximately 48 h postmortem, the left side of each carcass was physically separated into lean, inseparable lean (a combination of fat and lean tissues trimmed from bone), fat, bone and skin components. Soft tissue aggregates were weighed and then ground (Biro Model 5424852) individually through a .375 inch plate. Samples were ground a second time through a .125 inch plate. One-pound samples were collected randomly from the second grind and frozen at -22^{O}F. The frozen samples from each tissue group were cubed using a band saw (Biro Model 44), immersed in liquid nitrogen and subsequently powdered in a Waring Commercial Blendor (Model 34BL22). Powdered samples were stored in whirl-pack bags at -22^{O}F until proximate analysis was performed.

All aggregate samples were analyzed in triplicate. Samples were dried at 216^{O}F for 24 h to determine moisture content. Lipid content was determined by ether extraction. Protein analysis was performed with a KJELTEC Auto 1030 Analyzer. Ash was measured after samples were held 8 h at 1250^{O}F in an oven.

The femur and 10th rib bone were obtained from each side for proximate analysis. Bone samples were trimmed of any remaining external tissue, vacuum packaged and stored at -22^{O}F. These samples were placed in liquid nitrogen and pulverized (Micro Mill 372520000) until powdered. Previously described procedures were used for triplicate proximate analysis of rib and femur bones.

Data were analyzed using the model of treatment, sex-class and the treatment x sex-class interaction. Least squares means were partitioned following dosage-based contrasts (control versus pooled and individual treatment groups).

Results and Discussion

Least squares means for protein, lipid, moisture and ash content stratified by tissue group and somatotropin treatment level are reported in Table 1.

Table 1. Pounds of soft tissue protein, lipid, moisture, and ash stratified by porcine somatotropin (pST) dosage.

	pST dose, mg/d						
Item	0	.71	1.43	2.86	4.29	SE	P[a]
Lean:							
protein	5.6	5.9	6.3	6.5*	6.3	.25	.10
lipid	1.4	1.6	1.6	1.7	1.4	.15	.55
moisture	19.3	20.8	22.0*	23.4**	22.6*	.81	.018
ash	.28	.31	.32*	.35**	.33*	.013	.018
IS Lean[b]:							
protein	2.6	2.6	2.6	2.9	2.8	.12	.24
lipid	3.0	3.0	2.7	2.6	2.5	.25	.51
moisture	9.1	9.4	9.4	10.4	10.6	.56	.26
ash	.13	.14	.14	.15	.15	.008	.30
Fat:							
protein	.93	.95	.95	.94	.88	.07	.96
lipid	24.1	21.9	19.2	15.0**	15.7**	1.64	.003
moisture	2.8	2.9	2.9	2.5	2.8	0.12	.17
ash	.05	.05	.05	.04	.04	.002	.18
Total:							
protein	9.1	9.4	9.9	10.4*	10.0	.32	.08
lipid	28.5	26.4	23.5	19.3**	19.6**	1.75	.004
moisture	31.2	33.1	34.4*	36.3**	36.0**	1.00	.016
ash	.46	.49	.51*	.54**	.52*	.016	.02
Protein/Water ratio	.29	.28	.28	.28	.27*	.003	.22
Protein/Lipid ratio	.35	.36	.43	.55**	.52**	.03	.002

[a] Probability of treatment effect. Mean differs from that of negative control * P<.05; ** P<.01.

[b] IS Lean = Inseparable lean and fat.

Consistent improvement in side chemical composition was attained once pST dosage level reached 2.86 mg/day. The latter treatment group had higher (P<.05) weights of protein, moisture and ash as well as less (P<.05) total lipid than the control group. This resulted from higher protein, moisture and ash levels in the lean component and lower lipid levels in the fatty tissue. Protein-to-lipid ratios were also highest for the 2.86 mg/day level. Little additional enhancement was achieved in chemical composition by increasing the pST dosage level to 4.29 mg/day.

Similar trends were evident for chemical composition data expressed as a percentage of side weight (Table 2). Hogs treated with 2.86 mg pST/day produced carcasses with higher (P<.05) percentages of protein, moisture and ash; lower (P<.05) percentages of ether-extractible lipid.

The effects of pST level on femur and rib bone chemical composition are presented in Table 3. A dosage level of 2.86 mg/day resulted in an increased femur weight, a higher percentage of moisture (femur and rib) and a decreased percentage of ash (femur and rib). Percentages of protein and lipid remained unchanged regardless of pST dosage level.

Chemical composition data stratified by sex-class are presented in Tables 4, 5 and 6. Gilts had a greater amount of protein from inseparable lean and total soft tissue coupled with an increased amount of moisture from fat tissue than barrows (Table 4). Also, gilts had decreased amounts of lipid from fat and total soft tissue, and increased amounts of moisture and ash from total soft tissue. The protein/lipid ratio was higher (P<.05) for gilts. Gilts had higher percentages of moisture and protein in fat and total soft tissue, increased ash percentage in fat tissue, and a greater percentage of moisture in lean tissue (P<.05). Furthermore, gilts possessed a lower (P<.05) percentage of lipid in lean, fat and total soft tissue. Proximate analysis indicated that gilts had increased lipid and decreased moisture percentages in femurs. Sex class effects were not significant for rib chemical composition.

The proximate analysis of the soft tissue components indicate that a dosage level of 2.86 mg/day or more decreases lipid and increases protein and moisture. Additionally, gilt carcasses have higher protein and moisture levels as well as lower lipid contents than barrow carcasses.

Table 2. Proximate analyses of soft tissue components stratified by porcine somatotropin (pST) dosage.

	pST dose, mg/d						
Item	0	.71	1.43	2.86	4.29	SE	P[a]
Lean:							
protein %	20.84	20.48	20.82	20.34	20.4	30.21	.37
lipid %	5.23	5.54	5.34	5.32	4.5	10.55	.73
moisture %	72.04	72.20	72.78	73.01*	73.49**	.26	.005
ash %	1.04	1.06	1.07	1.08*	1.07	.01	.24
IS Lean[b]:							
protein %	16.66	16.53	17.11	17.51	16.97	.35	.34
lipid %	20.01	19.02	17.73	15.62	15.37	1.67	.24
moisture %	59.24	60.38	61.01	62.72	62.94	1.41	.32
ash %	.85	.87	.88	.91	.90	.02	.53
Fat:							
protein %	3.45	3.61	4.02	5.09*	4.53	.49	.16
lipid %	83.49	82.92	81.06	75.78*	78.26	1.95	.056
moisture %	10.37	10.96	12.43	13.29*	14.58**	0.82	.011
ash %	.17	.18	.20	.21*	.21*	.01	.10
Total:							
protein %	10.82	11.15	11.90	12.62**	12.18*	0.40	.03
lipid %	33.83	31.29	28.25	23.42**	23.86**	2.00	.005
moisture %	37.19	39.14	41.34*	44.23**	43.87**	1.34	.005
ash %	.54	.58	.61*	.66**	.64**	.02	.009

[a] Probability of treatment effect. Mean differs from that of negative control * P<.05; ** P<.01.

[b] IS Lean = Inseparable lean and fat.

Table 3. Effect of porcine somatotropin (pST) dose on weight and proximate analyses of femur and rib bones.

	pST dose, mg						
Item	0	.71	1.43	2.86	4.29	SE	P[a]
Femur:							
weight, oz.	8.9	9.3	9.5	9.9*	9.6	.26	.15
protein, oz.	1.4	1.5	1.6*	1.6*	1.5	.04	.12
moisture, oz.	2.6	2.7	2.8*	3.1**	3.0**	.07	<.001
lipid, oz.	1.8	1.7	1.7	2.0	1.9	.15	.77
ash, oz.	2.8	3.0	2.9	2.8	2.8	.08	.60
protein, %	16.2	16.4	16.8	16.1	16.1	.46	.78
moisture, %	29.1	28.8	30.0	31.5*	31.2*	.62	.016
lipid, %	19.9	18.6	18.3	19.8	19.8	1.24	.81
ash, %	31.5	31.9	30.9	28.6*	29.4	.79	.03
Rib:							
weight, oz.	1.0	.94	.98	.94	1.0	.04	.78
protein, oz.	.21	.20	.21	.20	.21	.009	.78
moisture, oz.	.35	.33	.34	.35	.38	.019	.56
lipid, oz.	.07	.06	.05	.06	.08	.007	.27
ash, oz.	.34	.31	.34	.30	.30	.016	.24
protein, %	20.9	21.7	21.7	21.4	21.1	.35	.41
moisture, %	34.8	35.7	35.0	37.4*	38.1**	.74	.016
lipid, %	6.6	6.5	5.5	6.5	7.9	.64	.18
ash, %	34.0	33.5	34.4	31.5*	29.9**	.84	<.01

[a] Probability of treatment effect. Mean differs from that of negative control * P<.05; ** P<.01.

Table 4. Pounds of soft tissue protein, lipid, moisture, and ash stratified by sex-class.

Item	Sex-class		SE	P[a]
	Gilt	Barrow		
Lean:				
protein	6.3	5.9	.35	.11
lipid	1.4	1.6	.22	.11
moisture	22.4	20.9	1.15	.052
ash	.33	.31	.018	.08
IS Lean[b]:				
protein	2.9	2.6	.18	.017
lipid	2.7	2.8	.35	.87
moisture	10.3	9.3	.79	.06
ash	.15	.14	.011	.14
Fat:				
protein	.99	.87	.10	.08
lipid	17.4	21.0	2.32	.02
moisture	2.9	2.7	.17	.02
ash	.05	.05	.003	.94
Total:				
protein	10.1	9.4	.45	.013
lipid	21.6	25.4	2.48	.02
moisture	35.6	32.8	1.52	.009
ash	.52	.49	.023	.03
Protein/Water ratio	.28	.28	.005	.91
Protein/Lipid ratio	.50	.39	.05	.004

[a] Probability of treatment effect. Mean differs from that of negative control * P<.05; ** P<.01.

[b] IS Lean = Inseparable lean and fat.

Table 5. Proximate analyses of soft tissue components stratified by sex-class.

	Sex-class			
Item	Gilt	Barrow	SE	P[a]
Lean:				
protein %	20.6	20.6	.31	.80
lipid %	4.6	5.8	.79	.02
moisture %	73.2	72.3	.36	.001
ash %	1.07	1.06	.01	.43
IS Lean[b]:				
protein %	17.2	16.7	.49	.08
lipid %	16.6	18.5	2.36	.22
moisture %	62.0	60.5	1.99	.24
ash %	.89	.88	.03	.75
Fat:				
protein %	4.7	3.6	.70	.017
lipid %	77.4	83.3	2.76	.003
moisture %	13.8	10.9	1.16	<.001
ash %	.21	.18	.02	.02
Total:				
protein %	12.1	11.3	.57	.03
lipid %	25.7	30.6	2.83	.012
moisture %	42.6	39.7	1.90	.02
ash %	.62	.59	.02	.09

[a] Probability of treatment effect. Mean differs from that of negative control * P<.05; ** P<.01.

[b] IS Lean = Inseparable lean and fat.

Table 6. Effect of sex-class on weight and proximate analyses of femur and rib bones.

Item	Sex-class Gilt	Barrow	SE	P[a]
Femur:				
weight, oz.	9.6	9.3	.37	.15
protein, oz.	1.5	1.5	.05	.77
moisture, oz.	2.8	2.9	.10	.25
lipid, oz.	2.0	1.7	.21	.03
ash, oz.	2.9	2.8	.11	.33
protein, %	16.1	16.6	.65	.29
moisture, %	29.2	31.1	.87	<.01
lipid, %	20.5	18.1	1.76	.04
ash, %	30.3	30.6	1.11	.70
Rib:				
weight, oz.	.99	.96	.06	.47
protein, oz.	.21	.20	.01	.26
moisture, oz.	.36	.34	.02	.40
lipid, oz.	.06	.07	.01	.36
ash, oz.	.32	.32	.02	.98
protein, %	21.5	21.2	.50	.44
moisture, %	36.3	36.0	1.04	.70
lipid, %	6.2	7.0	.91	.16
ash, %	32.1	33.2	1.19	.18

[a] Probability of treatment effect. Mean differs from that of negative control * P<.05; ** P<.01

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