1053 **Immune response and growth of stressed weanling pigs supplemented with organic or inorganic forms of chromium.** E. van Heugten* and J. W. Spears. North Carolina State University, Raleigh.

This study was designed to investigate the effect of chromium supplementation to stressed weanling pigs on growth and immune function. Ninety-six, 3-wk-old crossbred weanling pigs were allotted to one of eight treatments based on weight and litter origin. Treatments were arranged in a 2 x 4 factorial randomized complete block design. Factors included: 1) immune challenge or control; and 2) 0, or .2 ppm of Cr from either $CrCl_3$, Cr-picolinate, or Cr-nicotinic acid complex. *Escherichia coli* (serotype 055:B5) lipopolysaccharide (LPS) was used as stress inducing compound and was injected on d 7, 10, and 13 of the experiment at a rate of 200 μg LPS/kg BW. In vitro cellular immune response was measured on d 9 using a lymphocyte blastogenesis assay. Antibody response to sheep red blood cells (SRBC) and ovalbumin was measured 0, 7, and 14 d after antigen injection on d 10. In vivo cellular immune response was estimated by skin thickness response following subcutaneous injection of phytohemagglutinin on d 31 of the study. Body weight and feed intake were measured weekly. Immune challenge with LPS decreased ADG by 8.5% ($P < .05$) and ADFI by 6.4% ($P < .10$). Supplementation with Cr was not effective ($P > .10$) in alleviating the reduction in performance due to LPS. However, Cr supplementation to control pigs increased ADG by 13.9% and ADFI by 9.2% ($P < .10$). No interactive effects between immune challenge and Cr supplementation were observed for immune response measurements ($P >. 10$). Antibody response to SRBC and ovalbumin were increased in LPS challenged pigs ($P < .001$). Pigs supplemented with Cr-nicotinic acid had increased antibody titers to SRBC ($P < .10$), but antibody response to ovalbumin was reduced in pigs supplemented with organic forms of Cr ($P < .05$). In vivo cellular immunity was not affected by Cr supplementation. Lymphocyte proliferation in response to mitogens was increased in non-challenged pigs that were supplemented with Cr ($P < .10$). Results indicate that performance and aspects of immunity of weanling pigs may be improved by Cr supplementation.

Key Words: Immune Response, Chromium, Pigs, Inflammation

1054 **The effects of dietary carnitine, betaine, and chromium nicotinate supplementation on growth and carcass characteristics in growing-finishing pigs.** J.W. Smith, II,* K.Q. Owen, J.L. Nelssen, R.D. Goodband, M.D. Tokach, K.G. Friesen, T.L. Lohrmann[1], and S.A. Blum[2]. Kansas State University, Manhattan, [1]Vita Plus Corp., Madison, WI, and [2]Lonza Inc., Fair Lawn, NJ.

Sixty-four pigs (initially 34.0 kg) were used to determine the effects of dietary betaine, carnitine, and chromium nicotinate on growth performance and carcass composition. Pigs were blocked by sex, ancestry, and weight and allotted in a randomized complete block design to each of four dietary treatments. The four dietary treatments were: 1) negative control, 2) 50 ppm carnitine, 3) 1,000 ppm betaine, and 4) 200 ppb chromium from chromium nicotinate. Grower diets (34 kg to 56.7 kg) were formulated to contain 1.0% lysine and finisher diets (56.7 kg to 102 kg) were formulated to contain .8% lysine. All diets were corn-soybean meal based and fed in meal form and contained .15% L-lysine HCl and 2.5% soy oil. When mean pen weight reached 102 kg, one pig per pen was selected at random and slaughtered to obtain carcass measurements. During the grower phase, pigs fed carnitine had greater ADG ($P < .05$) and gain to feed ratio (G/F) than pigs fed the control diet. However, during the finishing phase and overall, there were no differences observed for ADG, G/F, or ADFI. Pigs fed carnitine had larger longissimus muscle area (LMA) and greater percent muscle (% Muscle; $P < .05$) than pigs fed the control or betaine diets. Also, pigs fed carnitine had lower tenth rib backfat thickness (TBF; $P < .05$) compared to those fed the control diet. Average backfat thickness (BF) was lower ($P < .05$) in the pigs fed carnitine or chromium nicotinate than pigs fed the control diet. These results indicate that carnitine and chromium nicotinate supplementation are viable means of increasing carcass leanness in growing-finishing pigs. Further study of the metabolism of carnitine, chromium nicotinate, and betaine is needed to examine possible modes of action in the growing-finishing pig.

		Control	Carnitine	Betaine	Chromium	CV
Grower	ADG, kg	$.86^b$	$.95^a$	$.91^{ab}$	$.92^{ab}$	8.1
34 to 56.7 kg	ADFI, kg	2.17	2.23	2.21	2.26	7.2
	G/F	$.40^b$	$.42^a$	$.41^{ab}$	$.41^{ab}$	6.2
Finisher	ADG, kg	.96	.94	.99	.95	7.7
56.7 to 102 kg	ADFI, kg	3.16	3.04	3.14	3.12	6.0
	G/F	.30	.31	.32	.31	5.8
Overall	ADG, kg	.92	.94	.96	.94	6.7
34 - 102 kg	ADFI, kg	2.83	2.77	2.83	2.83	5.4
	G/F	.33	.34	.34	.33	5.2
Carcass	LMA, cm^2	31.4^b	35.0^a	30.9^b	32.4^{ab}	9.0
102 kg	TBF, cm	3.02^b	2.52^a	2.92^{ab}	2.68^{ab}	18.3
	BF, cm	3.18^b	2.89^a	3.07^{ab}	2.90^a	10.2
	% Muscle*	51.56^b	53.94^a	51.81^b	52.96^{ab}	4.0

[ab] Means in row with different superscripts differ ($P < .05$).

* Percent muscle derived from NPPC formula for carcass muscle with 10% fat.

Keywords: betaine, carnitine, chromium nicotinate, pigs, grow-finish

1055 **The effect of L-carnitine on growth performance and carcass characteristics of growing-finishing pigs.** K.Q. Owen*, J.W. Smith II, J.L. Nelssen, R.D. Goodband, M.D. Tokach, K.G. Friesen, and S.A. Blum[1]. Kansas State University, Manhattan, and [1]Lonza, Inc., Fairlawn, NJ.

Ninety-six crossbred pigs (initially 34.0 kg BW) were used to investigate the effect of increasing dietary carnitine on growth performance and carcass characteristics in growing-finishing swine. Pigs (48 barrows and 48 gilts) were blocked by weight, ancestry, and sex in a randomized complete block design (two pigs/pen and eight pens/treatment). Dietary carnitine replaced corn starch in the control diet to achieve added dietary carnitine levels of 25, 50, 75, 100, and 125 ppm. Grower diets (34 to 56.7 kg) were formulated to contain 1.0% lysine and finisher diets (56.7 to 103 kg) were formulated to .80% lysine. All diets were corn-soybean meal based and fed in meal form and contained .15% L-lysine HCl and 2.5% soy oil. Pig weights and feed disappearance were recorded every 14 d to determine ADG, ADFI, and feed efficiency (G/F). When the mean weight for pigs in a pen reached 103 kg, one pig/pen was slaughtered to determine longissimus muscle area (LMA), average backfat thickness (BF), and tenth rib backfat thickness (TBF). Dietary carnitine did not influence growth performance during the growing or finishing phases ($P > .10$). However, for the overall trial, pigs fed dietary carnitine had numerically higher ADG ($P = .16$) and G/F ($P = .12$) when compared to pigs fed the control diet. Dietary carnitine reduced BF and TBF (quadratic, $P < .05$) and increased LMA (quadratic, $P = .13$) with 50 ppm providing the maximum response. These data suggest that dietary carnitine fed during the growing-finishing phase had no effect on growth performance, but resulted in increased LMA and decreased BF and TBF.

		Dietary Carnitine, ppm						
Phase		0	25	50	75	100	125	CV
Grower	ADG, kg	.86	.92	.95	.91	.93	.93	8.6
	G/F	.40	.39	.42	.41	.41	.41	6.6
Finisher	ADG, kg	.95	.97	.94	.97	1.00	.95	6.1
	G/F	.30	.31	.31	.31	.32	.31	5.5
Overall	ADG, kg	.92	.95	.94	.95	.98	.94	5.5
	G/F	.33	.33	.34	.34	.34	.34	4.9
Carcass	LMA, cm^2 [ab]	31.37	28.97	35.16	31.81	31.03	31.46	8.7
	BF, cm[a]	3.17	3.25	2.91	3.00	3.10	3.25	10.9
	TBF, cm[a]	3.00	3.15	2.52	2.72	2.95	3.12	16.5

[a,b]Quadratic effect of dietary carnitine ($P < .05$) and ($P = .13$), respectively.

Key Words: L-Carnitine, Pigs, Growth.

1056 **Influence of PST and dietary P level on percentage and accretion rates of chemical components of the ham in finishing pigs. S.D. Carter* and G.L. Cromwell, Univ. of Kentucky, Lexington.** Sixty-six barrows were fed corn-soy diets (1.3% lysine) containing .35 to 1.10% P from 72 to 114 kg (See JAS 71:166, Suppl.1). One-half were injected daily with 4 mg porcine somatotropin (PST, Monsanto, Chesterfield, MO.) Chemical composition (H_2O, CP, fat, and ash) was determined on the dissected lean tissue (LT), bone, and fat from the right ham for each pig and six additional pigs killed at the beginning of the study. For LT and bone, PST increased the percentage (%) and accretion rates of H_2O and CP ($P < .10$), but it reduced those of fat ($P < .01$). PST reduced ($P < .01$) the % ash of bone; it reduced ash accretion at the lower P levels and increased ash accretion at the higher P levels (PST x P, $P < .01$). The chemical components of LT and bone responded more to increasing P in treated pigs than in controls. The chemical components of the LT, fat tissue, and bone were combined to determine the composition and accretion rates for the skinned ham. PST increased the % and accretion rates of H_2O, CP, and ash in the ham, but it reduced those of fat ($P < .01$). Increasing P tended to improve the % and accretion rates of H_2O, CP, and fat quadratically ($P < .10$) in treated pigs, but it did not affect those traits in controls. The % and accretion rate of ash responded quadratically to increasing P in controls and linearly in treated pigs (PST x P, $P < .01$). These results indicate that PST-treated pigs require higher dietary P than non-treated controls to maximize H_2O, CP, and ash accretion and to minimize fat accretion, regardless of tissue type.

P, %:	.35	.50	.65	.80	.95	.35	.50	.65	.80	.95	1.10	SE
PST:	-	-	-	-	-	+	+	+	+	+	+	
Femur Chemical Accretion, g/d:												
Water	.54	.75	.73	.68	.72	1.27	1.34	1.49	1.37	1.41	1.36	.16
Protein	.25	.38	.38	.34	.38	.38	.44	.56	.54	.60	.60	.06
Fat	.44	.56	.53	.55	.55	.34	.21	.27	.28	.34	.34	.08
Ash	.41	.71	.75	.75	.75	.27	.51	.78	.92	1.09	1.12	.09
Skinned Ham Chemical Accretion, g/d:												
Water	41.0	39.7	38.9	42.2	34.5	60.7	72.6	74.5	68.8	72.3	64.4	4.4
Protein	12.7	12.1	12.6	13.3	11.7	19.1	21.4	22.3	21.4	22.1	19.7	1.3
Fat	33.1	33.6	33.6	38.6	36.1	25.5	26.0	18.7	19.3	25.6	22.0	2.5
Ash	1.58	2.17	2.23	2.23	2.13	1.63	2.44	2.96	3.06	3.52	3.44	.21

Key Words: Pigs, Phosphorus, Somatotropin