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Dietary source of selenium in nulliparous sows: the importance of vitamin B6 for some aspects of antioxidant status and ovulation during the peri-estrus period

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Nonruminant Nutrition: Mineral

W201 Effect of a partial replacement of limestone by a CaSO₄-zeolite mixture combined with a slight protein reduction on production indices, egg quality and excreta pH in laying hens. C. Romero*¹, E. M. Onyango², W. Powers³, R. Angel⁴, and T. J. Applegate⁵, ¹Universidad Politécnica de Madrid, Spain, ²East Tennessee State University, ³Michigan State University, East Lansing, ⁴University of Maryland, ⁵Purdue University, IN.

A commercial diet (CM diet; 17.4% CP and 4.37% Ca) was compared with a diet with 35% replacement of limestone by a CaSO₄-zeolite mixture (5.76% CaSO₄ and 1.18% zeolite) and a 0.4 percentage units reduction in protein content (RE diet) in laying hens. Apparent N retention, egg production, egg composition and excreta pH were measured. Previous studies demonstrated that the RE diet reduced ammonia emissions by 48%. Laying hens (192 total; 48 replicate cages per diet with 2 hens per cage; 1441 ± 135 g initial BW) were fed experimental diets from 33 to 49 wk of age. Apparent N retention averaged 48.2% ($P > 0.05$). Egg production (83.6%) and number of shell-less eggs (0.18%) were not affected by the diet. Eggs tended to be heavier (59.4 vs. 58.8 g/egg, $P = 0.06$) and yolk percentage (29.7 vs. 29.0%, $P = 0.013$) was greater with the RE diet. At 48 wk of age, the total solids content per egg was also greater from hens fed the RE diet (13.2 vs. 12.6 g/egg, $P = 0.032$). Other egg components were not influenced by diet (58.1% of albumen and 9.04% of shell). Feeding the RE diet resulted in a higher specific gravity (1.0786 vs. 1.0656 g/g, $P = 0.014$) only when hens were 44 wk-old. At the end of the experiment, excreta were collected from all cages (excreta from 3 cages were mixed and pooled; 16 pools of excreta per diet). At collection, excreta of hens fed the RE diet had lower pH (5.89 vs. 6.54, $P < 0.001$) and higher moisture content (74.0 vs. 70.9%, $P < 0.001$) than those of hens fed the CM diet. After 7 d of storage, excreta pH of hens fed the RE diet continued to be lower (6.30 vs. 8.36, $P < 0.001$). A slight reduction in dietary protein and replacing a portion of the Ca from CaCO₃ with CaSO₄ did not affect egg production nor did it impair shell quality. Feeding the RE diet to laying hens resulted in a reduction in excreta pH, even after 7 d of storage, as compared with laying hens fed the CM diet.

Key words: calcium sulfate, egg quality, protein reduction

W202 Dietary sources of selenium in nulliparous sows: The importance of vitamin B₆ status for some aspects of antioxidant status and ovulation during the peri-estrus period. M. Roy*^{1,2}, I. Audet¹, M.-F. Palin¹, H. Quesnel³, F. Guay², and J. J. Matte², ¹Agriculture and Agri-Food Canada, Sherbrooke, QC, Canada, ²Laval University, Québec, QC, Canada, ³Institut National de la Recherche Agronomique, St-Gilles, France.

In this experiment, it was hypothesized that there is an interaction between pyridoxine (B₆) and selenium (Se) metabolisms for an adequate flow of organic Se (Se-cysteine) toward the glutathione peroxidase (GPX) system in response to oxidative pressure induced by the peri-estrus period in sows. Forty-five gilts received one of the 5 dietary treatments (n = 9/group): 1) basal diet (Se = 0.2 mg/kg and B₆ = 2.5 mg/kg (C)); 2) # 1 + 0.3 mg/kg Na-Se (MSe0B₆); 3) # 2 + 10 mg/kg B₆ (MSe10B₆); 4) # 1 + 0.3 mg/kg Se-yeast (OSe0B₆) and 5) # 4 + 10 mg/kg B₆(OSe10B₆). Treatments started at first pubertal estrus and lasted up to 3 d after fourth estrus. Blood was collected from all gilts at each estrus. At slaughter, liver and kidneys were collected and corpora lutea were counted. At fourth estrus, blood Se was lower in C vs Se gilts and higher in OSe's vs MSe's (229.0, 251.2, 250.7, 288.9 and 282.6 µg/L

in groups 1, 2, 3, 4 and 5, respectively, SE = 7.3)($P < 0.01$) while blood GPX activity was higher in MSe vs OSe gilts and both were higher vs C's (117.6, 148.3, 145.6, 125.6 and 131.9 mU/mg hemoglobin in groups 1, 2, 3, 4 and 5, respectively, SE = 6.4)($P < 0.01$). In spite of Se effects (as in blood, $P < 0.01$) on Se in liver (0.7, 0.8, 0.7, 1.0 and 1.0 µg/g in groups 1, 2, 3, 4 and 5, respectively, SE = 0.1) and kidneys (2.5, 2.5, 2.4, 2.7 and 2.7 µg/g in groups 1, 2, 3, 4 and 5, respectively, SE = 0.1), there was no treatment effect ($P > 0.50$) on GPX activity in these tissues. However, gene expressions of cytosol GPX (GPX1) and Se-cysteine oxidase (control of the flow of Se-cysteine to the GSH-Px system) in both liver and kidneys were 50 to 70% higher in OSe10B₆ gilts than in others (interaction Se x B₆, $P < 0.01$). Ovulation rate were 17.4, 16.7, 17.7, 16.9 and 21.2 (SE = 0.9) in groups 1, 2, 3, 4 and 5, respectively (B₆ effect $P < 0.01$, Se effect $P < 0.06$ and interaction B₆ x Se, $P < 0.09$). In conclusion, dietary B₆ is a modulating factor of the metabolic pathway of organic Se toward the GPX system and may be involved in ovarian function leading to optimal ovulation conditions.

Key words: selenium, vitamin B₆, gilt

W203 Effects of high dietary selenium supplementation on fasting plasma glucose and lipid profiles of young pigs. E. Isaacs*, K. Roneker, and X. G. Lei, Cornell University, Ithaca, NY.

Recent animal and human studies have shown an intriguing pro-diabetic, hyperglycemic, or hyperlipidemic effect of high dietary intakes of Se that are suggested for cancer prevention. This experiment was conducted to establish a pig model to determine whether a high Se concentration in a corn-soybean meal basal diet (BD) affected plasma glucose concentrations and lipid profiles. A total of 16 weanling pigs (BW = 7.47 ± 0.78 kg) were divided into 2 groups (n = 8/group) and fed the BD supplemented with 0.3 or 1.0 mg Se/kg (as sodium selenite) for 8 wk. Growth performance and fasting plasma glucose, total triglyceride, and total cholesterol concentrations were measured at initial and then biweekly. Weekly or overall ADG, ADFI, and gain/feed efficiency were similar between the 2 dietary Se concentrations. There was no significant effect ($P = 0.1$) of dietary Se supplementation on fasting plasma glucose concentrations (mg/L) (from Wk 0 to Wk 8 = 1207.9 ± 336.8 to 727.9 ± 84.5 vs. 1359.9 ± 169.7 to 845.6 ± 195.6). Likewise, fasting plasma concentrations of total triglyceride and total cholesterol were not different ($P = 0.85$) between the 2 dietary Se groups. In conclusion, supplementing the corn-soy diet with 1 mg of Se/kg for 8 wk might not be sufficient to alter fasting plasma glucose or lipid profiles of weanling pigs.

Key words: glucose, lipid, model pigs, plasma, selenium

W204 Bioavailability of zinc from zinc propionate in chicks. M. A. Brooks*, J. L. Grimes, S. Verissimo, K. L. Murphy, and J. W. Spears, North Carolina State University, Raleigh.

The purpose of this experiment was to evaluate the relative bioavailability value (RBV) of Zn propionate (ZnProp) relative to feed-grade ZnSO₄ using body weight gain and bone zinc as response criteria. One hundred day-old Ross chicks were fed a semi-purified starter diet deficient in Zn for 7 d post-hatching (22 mg Zn/kg). Chicks were randomly sorted into one of 5 treatments (n = 20) with 5 replicate pens of 4 birds per pen. The experimental control diet (20 mg Zn/kg) differed from the starter diet in that ground corn replaced approximately 30% of the