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Costa Rica (CR-PKM) was determined based on tibia bone ash, relative to KH_2PO_4. From 8 to 18 d-of-age, P-deficient corn-soybean meal diets supplemented with 0.05 and 0.1% P from KH_2PO_4 or 15 and 30% M-PKM and CR-PKM were fed to 6 replicate pens of 5 chicks. Data were analyzed using a one-way ANOVA and multiple regression analyses. In Experiment 3, a broiler chicken assay was conducted to determine apparent ileal P digestibility for M-PKM and CR-PKM at 2 dietary Ca levels in 2x2 factorial treatment arrangement. Diets were fed from 18 to 22 d of age. Semi-purified diets containing 45% M-PKM or CR-PKM as the sole source of P were fed at a Ca:total P ratio of 1.4 and 3.6. The latter ratio was increased by adding limestone to increase dietary Ca from 0.3% to 0.75%. Data were analyzed as a 2-way ANOVA with PKM and Ca:total P ratio as main effects. Chemical composition results (%), mean (range), were as follows: CP, 13.7 (11.2-16.6); fat, 7.5 (5.9-10.5); NDF, 64.4 (60.8-67.3); Ca, 0.4 (0.2-0.5); P, 0.7 (0.6-0.8); phytic acid, 1.3 (1.1-1.6). In Experiment 1, TME_n differed among PKM ($P<0.05$) and ranged from 1,644 – 2,439 kcal/kg DM for the 12 PKM. Standardized digestibility of AA varied among samples ($P<0.05$), e.g., digestibility of Lys varied from 35 to 60%. In Experiment 2, multiple regression of bone ash (mg/tibia) on supplemental P intake yielded a P bioavailability of 21 and 40% relative to KH_2PO_4 for M-PKM and CR-PKM, respectively. In Experiment 3, apparent ileal P digestibility was 38 and 24% in M-PKM and was 48 and 30% in CR-PKM at Ca:total P ratios of 1.4 and 3.6, respectively (main effect of PKM and Ca level, $P<0.05$). In conclusion, chemical composition, TME_n, and AA digestibility varied greatly among PKM from different countries and bioavailability and digestibility of P varied with dietary Ca level and method of determination.

128 Effects of methionine supplement sources and crude protein on Ross 708 male broiler performance. Darby Boontarue*[1], Fernanda L. Castro[2], Jinlei Wen[2], Courtney Poholsky[3], Brendan Liebross[4], John W. Boney[5]; [1]*Penn State University, , State College, Pennsylvania, United States;* [2]*Evonik Corporation, Kennesaw, Georgia, United States;* [3]*Penn State University, Howard, Pennsylvania, United States;* [4]*The Pennsylvania State University, Animal Science, Manalapan, New Jersey, United States;* [5]*Penn State University, Animal Science, University Park, Pennsylvania, United States.*

Nutritionists have access to various ingredients that fulfill methionine (Met) requirements of broilers. Amino acids (AA), such as DL-methionine, are nearly 100% bioavailable while methionine hydroxy analogs are shown to be relatively less bioavailable. Thus, this experiment aimed to determine the efficacy of using a 65% DL-methionine and 35% limestone dilution product (65DLM) compared to a methionine hydroxy analog (MHA) product when included in a diet deficient in total sulfur AA. A total of 3,072 Ross 708 male broilers received diets varying in Met source (none, MHA, or 65DLM) and crude protein (CP) (Standard or Reduced 2%). Treatments were arranged in a 2 x 3 factorial in a randomized complete block design. Each treatment was fed to 16 replicate floor pens with 32 broilers/pen across a 3-phase feeding program from d1-42. Broiler performance was measured during the starter (d1-10), grower (d11-24), finisher (d25-42), and overall (d1-42) periods. On d 24 and 42, litter was collected to determine litter moisture and three birds/pen were selected for footpad lesion scoring (FLS). On d42, three broilers +/- 10% of the average pen weight were selected for processing yield. Performance, litter moisture, and processing metrics were analyzed by two-way ANOVA using the GLM procedure of SAS. FLS were analyzed via descriptive statistics by using the frequency procedure of SAS. Broilers receiving Standard CP (SCP) with either MHA or 65DLM consumed 1,676 g more feed and gained 1,300 g more than Reduced CP (RCP) with no Met during d1-42 ($P<0.001$). Additionally, a d1-42 FCR interaction indicated a 0.3 FCR improvement ($P=0.007$) for broilers consuming SCP with either MHA or 65DLM compared to broilers consuming RCP with no Met. Overall, RCP-fed birds, regardless of Met source, showed reduced performance than their counterpart SCP treatments. At d24 and d42, both main effects impacted litter moisture ($P<0.05$). Birds fed SCP diets increased litter moisture when compared to birds fed RCP diets. Likewise, birds fed either MHA or 65DLM had higher litter moisture content than birds provided a diet with no Met supplementation. On d42, 23 SCP-fed birds had FLS other than "0" while only five RCP-fed birds had FLS other than "0". Breast weight was highest when 65DLM was included in SCP diets and reduced when MHA was provided in either RCP or SCP diets. Breast weight was intermediate when 65DLM was provided in RCP diets and were lowest when Met was not supplemented in RCP diets ($P=0.003$). Overall, this experiment indicates that 65 parts of DLM can replace 100 parts of MHA in formulation where broilers maintained performance and improved breast weight.

129 Supplemental dietary microalgae may be used to mitigate climate impacts of broiler production. Tao Sun*[1], Sahil Kalia[1], Xin Gen Lei[1]; [1]*Cornell University, Animal Science, Ithaca, New York, United States.*

Broiler production, similar to other animal agriculture, contributes to greenhouse gas (GHG) emissions of CO_2, CH_4, and N_2O. This study was to investigate the potential of feeding various microalgal biomasses in mitigating the GHG emissions from the chicken excreta. A total of 108 (day-old) Cobb male chicks were housed in an environmental control room (6 cages/treatment, 3 chicks/cage) and fed a corn-soybean meal basal diet supplemented with five microalgal biomass (*Nannochloropsis oceanica,* C417-LEA, C018-LEA, H117-LEA, and C417-H1) (provided by Duke University Marine Laboratory) at 17.5% between day 6 to 21. Growth performance was measured weekly. The animal excreta was collected from plastic pans beneath the meal wire floor in each cage (6 pans/treatment). At day 21, the excreta was weighed, sampled, and stored till analysis. Gas emission from excreta was analyzed weekly up to the fourth week using the gas concentration analyzer (G2508, Picarro, CA). Between the measurement, the excreta samples were stored at room temperature (around 25°C). The total track digestibility of nutrients was analyzed using 0.3% chromium oxide as an indirect marker in the diets. The data were analyzed by one-way ANOVA and Duncan's multiple comparisons. All microalgae supplementations at 17.5% decreased body weight gain by 26 to 49% ($P < 0.05$), without effect on feed intakes. The feed use efficiency (gain/feed) was decreased ($P < 0.05$) by 12 to 35%. On day 21, the *N. oceanica*, C018-LEA, and C417-H1 treatments lowered ($P < 0.05$) the emission of N_2O and NH_3 by 55% to 136%. Meanwhile, CO_2 production was reduced ($P < 0.05$, 48% to 271%) by all microalgae diets on day 7, 14, and 21. The total track nitrogen retention was increased ($P < 0.05$, 35 to 61%)