Relationship between amino acid concentration and digestibility using the two amino acids digestibility datasets

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ABSTRACT

Commercial companies databases (Evonik Degussa, ED, chick assays; and Ajinomoto Heartland, AH, rooster assays) were analyzed to test the hypothesis that amino acid (AA) digestibility = *f* (AA concentration) in the feed. Digestibility should be a property of the feed ingredient and not related to the concentration. Casual observation of a rooster assay database suggested that AA digestibility was related to its concentration. If the AAs concentration during an assay has a big affect on its digestibility, then the results may not be valid at different levels. It is generally assumed that nutrient digestibility does not change between classes of birds, and AA digestibility values generated with roosters are widely used in feed formulation for broilers, laying hens and turkeys. Total AA concentration (tAA) and digestible amino acids (dAA) averaged 6% and 14 % higher in the AH than ED database, respectively. Variation around the regression line between databases increased with increasing dAA concentration. Differences in assay type were quantitative as slopes of dAA = *f* (tAA concentration) were positive for 19 of 20 ingredients in each database. However, in one analysis, the influence of concentration on digestibility was very unlikely to be due only to chance ($P<0.0006$) as evidenced by concentration x assay type interaction. Removing AAs having lowest (TRP) or highest (ILE) concentration were not critical to the conclusion that dAA = *f* (tAA concentration). The effect of AA concentration on its digestibility was very similar for each AA except CYS. This relationship was also appeared to be related to the CP level in the ingredients and deviations from the mean were much larger with lower vs. higher protein supplements. Data from 3 research articles confirmed this relationship to not just be due to the different samples in the different databases. Therefore, to best predict digestibility of any AA in any ingredient, its intended concentration in the diet should be known. Further, AA digestibility values (% of diet) from the different databases are clearly not interchangeable.

Key Words: amino acids, digestibility, concentration, rooster, chick

Relationships of egg and chick weight on the performance of progeny from standard and dwarf broiler dams

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ABSTRACT

Eggs were collected from two commercial crosses (42 weeks of age) with the same male parent. One female parent was dwarf *(dw-)*. Broiler progeny performance as function of egg and chick weights was investigated. Fertility (91.7 vs 94.7%) and hatchability (95.2 vs 96.3%) were similar for eggs from standard and dwarf dams, respectively. Egg weight (EW) contributed significantly to variation in body weight (BW). A female broiler hatched from a 63 g egg from a dwarf dam was predicted to weigh 3107.77 + 7.61(63) -37.42 -576.32 = 2973 g at 50 d. The coefficient for chick weight (CW) was positive but non-significant. However, in one model, both egg and chick weights were highly significant. The negative coefficient for CW in one model suggested that of the two broilers of the same EW, the one with the greater CW would have the smaller 50 d BW. Chick weight was a linear function of EW but the little improvement in R^2 with the quadratic effect of EW indicated that the effect of egg or chick weight on broiler body weight at 35 or 50 d was best represented by a single linear function. Differences in BW due to EW increased with broiler age. The coefficients of egg and chick weights predicted that the differences in BW per g of egg were 1.43, 3.06, 6.24 and 7.61 g and per g of chick were 1.87, 3.99, 8.14 and 9.93 g, respectively, at 7, 21, 35, and 50 d. The coefficients relating BW to EW and CW increased by 0.1563 and 0.2092, respectively, per day of age for males from standard dams. Clearly both egg and chick weights are important for modeling or predicting market age broiler weight and economic returns. No significant differences were observed between 50 d body weight and hot carcass yields of broiler chicks from standard vs dwarf dams. These results compared to those from 1980's indicated that genetic selection has decreased the influence of EW on broiler growth and the present dwarf broiler breeder dams may produce progeny comparable in performance to the standard dams. However, the exact amount attributed to the dwarfing gene cannot be estimated from this study because of the different genetic backgrounds of these female parents.

Key Words: egg, chick, dwarfing gene, broiler, growth

Hazara rock phosphate as a source of phosphorus for broiler chickens

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ABSTRACT

The effects of replacing Dicalcium Phosphate (DCP) with Hazara rock phosphate (HRP) in relation to their fluorine (F) content was investigated on the growth performance of broiler chickens. Broiler chicks of the same weight were allocated into 5 treatments with 5 replicates of 10 chicks each. The HRP (having 3% F) was incorporated into a standard ration of corn-soybean meal by replacing 0, 25%, 50%, 75% and 100% of DCP; Thus the F contents of the diets were 0, 166, 332, 498 and 664 mg/kg, respectively. Placement of HRP (25%) in the diet increased average body weight gain (BWG) significantly while 100% HRP in the diet decreased ($P<0.05$) BWG ($BWG = 1128.6 + 2.6848\ RP - 0.0368\ RP^2$). Replacing 25% of DCP with the HRP did not influence feed consumption (FC), however, increasing the level of HRP caused a decline in FC ($FC = 2044 + 0.7885\ RP - 0.0369\ RP^2$). The effect of RP was not pronounced (significant at $P<0.05$) until 75% HRP was fed. Live BW was increased by 25% and 50% HRP. Higher levels of HRP did not cause significant differences in live BW. Replacing DCP with the HRP up to 50% showed significant increases in the relative weight of carcasses. Increasing the level of HRP in the diet did not affect Ca accumulation in the tibia. However, increasing HRP in the diet gradually decreased phosphorus accumulation in the tibia. Tibia P was lowest ($P<0.05$) with 75% and 100 % HRP in the diet. Serum Ca was increased by substituting HRP for DCP (linear effect). Increasing HRP in the diets simultaneously decreased the P content of the plasma. Plasma P was lowest ($P<0.05$) when DCP was replaced by 100% HRP, suggesting poor P availability from HRP. In conclusion, this study demonstrated that 25-50% replacement of DCP with HRP (having F contents of 166 to 332 mg/kg) could be used safely without affecting the growth performance of broiler chickens.

Poultry feed formulation results from different digestible amino acid databases

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ABSTRACT

This study showed how the different database values influence ingredient usage and feed cost for broiler, layer and turkey diets with recent ingredient costs from the USA and Pakistan. A series of feeds were formulated to compare results from using two commercial ingredient composition databases: Ajinomoto Heartland (AH, rooster) and Evonik Degussa (ED, chick). Total amino acids averaged 6% higher in the AH (rooster) than ED (chick) database and digestible amino acids averaged 14% higher in the rooster than chick assays. The ingredient composition matrix was based on NRC (1994) tables except for digestible amino acid and protein. Requirements were for a broiler starter (Ross), broiler finisher (Cobb), turkey starter (Nicholas), turkey finisher (BUT males), and layer prelay and peak (Hy-line) diets. Costs were local market prices in Pakistan (June 2010) and average USA prices (2009). Formula costs were higher using the ED digestible amino acid values, ranging from $0.90/ton for the turkey finisher to $ 8.20/ton for the turkey starter. The broiler starter and finisher diets were $6.00 and $2.40/ton higher using the ED digestible amino acid values. Differences in formulation costs were due to higher levels of supplemental amino acids and soybean meal when using the ED database. The shadow prices of distillers dried grain with soluble (DDGS) ranged from $199.30/ton in the turkey starter with AH digestible amino acid values to $245.40/ton in the prelay diet with AH digestible amino acid values. Not knowing the digestible amino acid levels in feed ingredients or choosing inappropriate digestible amino acid values may result (at least) in inefficiencies of 3 to 4 $/ton of finished feed for broilers, layers and turkeys. Comparative values are similar for dollar ($) and rupees (Rs). Differences in feed cost from using the different digestibility values can give an estimate of potential savings (costs) from using a particular database. The cost difference may be used to demonstrate the magnitude of research monies that should be dedicated to most accurately estimating amino acid digestibility values.

Effect of Balanced Dietary Protein Levels on Egg Production and Egg Quality Parameters in Commercial layers

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ABSTRACT The effects of series of balanced dietary protein levels on egg production and egg quality parameters in lying hens from 18 through 74 weeks of age were investigated in this experiment. One hundred and forty four pullets (Bovans) were randomly assigned to individual cages with separate feeders and were then equally assigned to three different protein level series with isocaloric diets. Diets were separated into 4 phases of 18-22, 23-32, 33-44 and 45-74 weeks. The protein levels of high protein (H) series were 21.62%, 19.05%, 16.32% and 16.05%, respectively. Medium protein (M) and low protein (L) series were 2% and 4% lower in balanced dietary protein. The results clearly demonstrated the balanced dietary protein level was the limiting factor for body weight, average daily feed intake (ADFI), egg weight, hen day egg production (HDEP) and feed per kilogram eggs. Feeding either the H or M series resulted in similar ADFI, HDEP (93.23% and 95.68% peak production, monthly basis), and feed per kilogram eggs whereas feeding with the L series resulted in lower ADFI and HDEP (90.33% peak production) and higher feed per kilogram eggs. Egg weight responded in a linear manner to balanced dietary protein level (58.78, 55.94 and 52.73 g for H, M and L, respectively). Feed intake of all hens, but especially those in the L series, increased considerably after week 54 when the temperature of the house decreased due to winter conditions. Thus hens fed the L series seemed particularly dependent on house temperature to maintain body weight, ADFI and HDEP. For egg quality parameters, percent yolk, Haugh units and egg specific gravity were similar regardless of diets. Haugh units were found to be greatly affected by the variation of housing temperature. Contrary to the idea of a daily amino acid “requirement”, these results may be used to determine profit maximizing levels of balanced dietary protein (and therefore amino acids). The approximation from overall mean value (entire experimental period), adding 2% protein to the M series will increase HDEP by 2.56%, egg weight by 2.84 g and decrease feed intake per kilogram eggs by 127 g.

Key words: laying hens, protein titration, egg production, egg quality.