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Changes in voluntary amino acid consumption in broiler chickens reflect their growth rate when given a choice

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In the wild the red junglefowl (ancestor of the modern chicken breeds) forages the rain forest eating a variety of leaves, plants, invertebrates, and small vertebrates to secure a balanced diet. Different individuals have slightly different requirements reflecting varying metabolic efficiencies of nutrient utilization. Thus, being able to select foods is fundamental to maintain nutritional balance and health.[(1)] However, under normal commercial conditions individual broilers have no other option than to consume a feed formulated to fulfill the nutritional requirements of the average bird in the flock thus potentially causing marginal nutrient deficiencies. This, in turn, may partially explain differences in growth rates between individuals. We tested the hypothesis that slow growing (SG) chickens have different amino acid (AA) preferences than fast growing (FG) individuals reflecting differences in AA metabolism and growth-related needs. We tested the voluntary intake of essential (Leu, Lys, Ile, Met, Thr, Trp, Val), conditional essential (His, Gly) and non-essential (Ala, Arg, Asp, Gln, Ser) AA in the top 10% FG (BW = 1206.0 ± 11.6 g) and the bottom 10% SG (BW = 961.2 ± 25.0 g) healthy chickens from the same flock. The experimental design consisted of a double-choice test between a balanced finisher broiler feed formulated without synthetic AA and the same feed supplemented with 0.5% of each individual AA. When given the choice, the FG and SG chickens consumed the same amount of L-Met, L-Thr, and L-Arg (this is up to the fourth limiting AA) matching the ideal ratio to L-Lys recommended by Baker.[(2)] In contrast, both groups of chickens chose to consume a high amount of L-Trp, 75% higher than the current recommended ratios to Lys.[(3)] Higher ratios to Lys were also observed for the three branched AA (BCAA). In addition, the growth rate was found to affect the voluntary consumption of several AA. FG chickens consumed more BCAA L-Ile and L-Val, and the non-essential AA L-Ala, and L-Asp ($p < 0.05$) than SG individuals. In turn, SG chickens showed a significantly higher preference for Gly compared to FG individuals ($p < 0.01$). Higher demand of Gly is required when excessive AA are in the diet, as part of the synthesis of uric acid.[(2)] The higher appetite for Gly may indicate an AA imbalance. Overall, regardless of the experimental groups based on growth (FG and SG), our results confirmed that chickens can balance their diet for the most limiting AAs when given the choice. Differences in AA appetites between FG and SG chickens may reflect differences in dietary AA needs. Additional research should be conducted to better understand the specific appetites for non-essential AA in chickens and the differences between FG and SG individuals. The authors would like to acknowledge AgriFutures Australia for investing in this research between 2014 and 2017 when known as Rural Industries Research and Development Corporation.

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