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Effects of substituting fish meal with poultry by-product meal in broiler diets on blood urea and uric acid concentrations and nitrogen content of litter

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This study was carried out to investigate the effects of dietary substitution of fish meal (FM) with poultry by-product meal (PBM) at 0%, 25%, 50%, 75% and 100% using 360, 1-day-old Arian broiler chicken. The birds were randomly allocated to 30 pens (at density of 0.08 m²/bird) in an open system partially controlled house. The chicks were raised under a photo regimen of 23:1h light to darkness up to 42 days. The five dietary treatments were offered to six replicates of 12 chicks each. Data on productive performance, serum concentrations of urea and uric acid and pH, moisture and nitrogen content of litter were collected at different ages. The mean weight gain, feed intake and feed conversion ratio were significantly decreased in the birds fed on diets containing more than 50% PBM compared to the control birds during days 1–21 of age ($P < 0.01$). Replacement of FM at different levels with PBM significantly affected either serum urea or uric acid concentrations ($P < 0.05$). The serum urea and uric acid concentrations was lower in the birds that received 100%-PBM containing diets. The mean nitrogen content of litter was similar among the experimental diets while the moisture content of litter tended to be lower for the birds fed on diets containing 25% PBM compared to the other birds ($P < 0.10$). No differences in litter pH were pointed out for dietary treatments. Treating the litter samples by Alum significantly increased their pH values ($P < 0.01$). The results suggest that, substitution of FM with PBM at different levels had no considerable impact on nitrogen contents of litter.

Keywords: blood urea; broiler chicken; poultry by-product meal; uric acid

Introduction

Litter management in poultry production, as a mean to reduce ammonia emission, has been received increasing attention in modern poultry houses. It is well documented that high concentrations of ammonia in poultry houses have detrimental effects on the performance and health of the birds (Koerkamp 1994; Al Homidman et al. 2003; Ritz et al. 2004). Moreover, concerns have arisen with regard to ammonia emission from poultry litter as it may contribute to acidic precipitations. Atmospheric ammonia plays an important role in such precipitations. It has been reported that livestock wastes are the dominant source of ammonia emission in Europe, which has increased by 50% during 1950–1980 (Van der Hoek 1998).

Ammonia volatilization from poultry houses is mainly due to microbial breakdown of nitrogenous compounds of litter, predominantly uric acid, by uricase (Kimberly et al. 2008; Schefferle 2008). Different approaches have been implemented to reduce ammonia emission from poultry houses. Among the others, dietary manipulations and litter treatments are effective means to control ammonia emission at poultry houses level. Litter treatments are ammonia-reducing strategies which provide a better in-house environment for birds (Khosravinia 2006; Choi et al. 2008). Dietary manipulations have the potential to reduce the manure production and nutrients excretion by improving the overall efficiency of feed utilization in poultry. Therefore, such dietary manipulations may decrease the production of precursors necessary for gaseous as well as odorants emissions (Blair et al. 1999).

The reduction in mass of nutrient input and modification of nutrient form are two feeding strategies to reduce ammonia emission form poultry. The former, reduces the ammonia emission by lowering the dietary concentrations of nutrients which are involved in production of ammonia, such as dietary protein without having any detrimental effects on birds performance (Angel et al. 2006; Applegate et al. 2008). The latter, reduces the nutrients emissions from poultry houses by altering the chemical forms of the nutrients being excreted. Acidification of diets (Keshavarz 1991; Koerkamp 1994; Wu et al. 2007) and dietary inclusion of feed additives (such as urease inhibitors; Amon et al. 1995) are among the approaches considered to reduce the emission of nutrients by converting them to non-volatile forms.