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Influence of whole hulled rice and rice husk feeding on the performance, carcass yield and digestive tract development of geese

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ABSTRACT

The present study was conducted to investigate the effects of hulled rice and rice husk feeding on the performance, carcass yield and digestive tract development of geese from 28 to 70 days of age. A total of 120 Yangzhou geese, 28 d old and with similar body weight, were distributed to 12 pens of 10 birds per pen. Each treatment was represented by 4 replicates. The experimental treatments were as follows: control diet based on ground maize, soybean meal and alfalfa meal (GM); experimental diet based on ground maize, soybean meal, ground hulled rice and rice husk (GR, 172 g ground hulled rice and 103 g rice husk/kg); experimental diet based on ground maize, soybean meal, whole hulled rice and rice husk (WR, 172 g whole hulled rice and 103 g rice husk/kg). Over the 28–70-day trial period, no significant difference ($P > 0.05$) was observed in the daily feed intake of geese, but birds receiving the WR treatment had the highest ($P < 0.05$) daily weight gain and body weight (70 d of age), and the lowest ($P < 0.05$) feed conversion ratio (FCR). The carcass yield was unaffected by GR and WR treatments ($P > 0.05$). Birds receiving the WR diet had the lowest ($P < 0.05$) relative weights and lengths of the jejunum, ileum and small intestine. The findings of this study suggest that hulled rice and rice husk are good ingredients in geese diet which have positive effects on body weight, daily weight gain and FCR.

1. Introduction

In recent years, the use of whole grains has been of interest in poultry feed industry in Northern European countries, Australia, and Canada (Gabriel et al., 2007; Amerah and Ravindran, 2008; Amerah et al., 2008). Feed cost savings can be achieved by decreasing energy consumption used for grinding, handling and processing (Reece et al., 1986; Amerah et al., 2009). In addition to reduced feed processing costs, other reported beneficial effects include improvements in performance, gut health and general flock health (Cummings, 1994; Forbes and Covasa, 1995; Svihus et al., 2010). Thus, the practical implication is that if the birds fed diets containing whole grains have performed at least as well as those fed ground diet then the economics will favour whole-grain feeding.

Abbreviations: GC, ground corn; GR, ground hulled rice and rice husk; WR, whole hulled rice and rice husk.

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Table 1
Ingredient and nutrient composition (g/kg, as fed) of the experimental diets.

Ingredient	GM	GR	WR
Maize	615	450	450
Soybean meal	165	240	240
Alfalfa meal	193	–	–
Ground hulled rice	–	172	–
Ground rice husk	–	103	–
Whole hulled rice	–	–	172
Whole rice husk	–	–	103
Limestone	5	10	10
Calcium hydrogen phosphate	10	13	13
Salt	2	2	2
Vitamin and trace mineral premix[a]	10	10	10
Nutrient composition			
Metabolisable energy (MJ/kg)[b]	10.89	10.87	10.87
Crude protein[c]	164.8	163.5	167.9
Crude fibre[c]	72.9	78.8	79.4
Neutral detergent fibre[c]	442.6	194.3	186.8
Acid detergent fibre[c]	141.1	121.9	118.3
Calcium[c]	7.6	7.7	7.2
Available phosphorus[c]	3.5	3.8	3.6
Lysine[d]	7.9	8.6	8.6
Methionine + cysteine[d]	5.5	5.4	5.4

GM, control diet based on ground maize, soybean meal and alfalfa meal; GR, experimental diet based on ground maize, soybean meal, hulled rice and rice husk; WR, where whole hulled rice and rice husk replaced ground hulled rice and rice husk in the GR diet.

[a] Supplied, per kilogram of diet: vitamin A (retinyl acetate), 30 mg; vitamin D3 (cholecalciferol), 0.5625 mg; vitamin E (di-α-tocopheryl acetate), 150 mg; vitamin K (2-methyl-1,4-naphthoquinone), 100 mg; thiamin, 50 mg; riboflavin, 600 mg; pyridoxine, 100 mg; vitamin B12 (cobalamin), 1 mg; nicotinic acid, 3 g; pantothenic acid, 900 mg; folic acid, 50 mg; biotin, 4 mg; choline, 35 g; Fe, 6 g; Cu, 1 g; Mn, 9.5 g; Zn, 9 g; I, 50 mg; Se, 30 mg.

[b] The values are calculated from ingredient AME values for chickens.

[c] Analysed values.

[d] Calculated values.

In most studies evaluating whole grain feeding, it has been indicated that inclusion of whole grain could stimulate the development of the gizzard and duodenum (Gabriel et al., 2003a,b; Lu et al., 2011a). Higher relative weights of the gizzard at 28, 49, and 70 d of age were observed in geese fed the whole maize diet compared with those fed the ground maize diet (Lu et al., 2011a). Taylor and Jones (2004) found that pre-pelleting inclusion of 200 g/kg of whole wheat increased relative gizzard weights of broiler chicken. Similar results were reported by Svihus et al. (2004) with pre-pelleting inclusion of 500 g/kg of whole wheat in broiler chicken diet. Limited data suggest that whole grain feeding may influence the development of duodenum (Gabriel et al., 2003a,b; Lu et al., 2011a). The effects of whole grains feeding on the size of digestive tract are therefore of practical interest.

The geese production is becoming specialised and more widespread. Geese are herbivorous waterfowl and consume large amounts of green grass, clover, and some plants (Kropp, 1975; Lu et al., 2011a,b). The geese has powerful gizzard, and there is effective microbial breakdown of fibre in the caeca and large intestine (Yang et al., 2009; Lu et al., 2011b), so they are able to utilise a high-fibre diet. However, due to the absence of feeding standards of ingredient composition for geese, farmers have to rely on personal experience in determining the feeding allowances. There are some studies in which the maize, soybean meal and alfalfa meal are used in geese production (Wang et al., 2009, 2010; Yang et al., 2009), and the hulled rice and rice husk are also used in geese rations. The inclusion of rice husk in geese diet could result in positive effects on performance, carcass yield, and digestive tract development (Lu et al., 2011b,c). However, few researches have been reported on the effects of the hulled rice and rice husk on geese. Thus, the objective of the current study was to investigate the influence of hulled rice and rice husk feeding on the performance, carcass yield and digestive tract development of geese.

The main hypothesis for this experiment was that the performance of geese given the hulled rice diet would be as well as those given maize diet (GM). Another hypothesis was that the whole rice diet (WR) with coarse particles would facilitate digestive tract development compared to the ground diet (GR).

2. Materials and methods

2.1. Diets

Three sets of diets were used in this trail, and the diet composition is shown in Table 1. The experimental treatments were as follows: control diet based on ground maize, soybean meal and alfalfa meal (GM); experimental diet based on ground maize, soybean meal, ground hulled rice and rice husk (GR); experimental diet based on ground maize, soybean meal, whole hulled rice and rice husk (WR). The maize, soybean and alfalfa meal was from the same batch of grain in the test year. The GR and WR were from the same batch of japonica rice in the test year. The diets (Table 1) were formulated to meet or exceed the NRC (1994) recommendations for geese. The diets were offered *ad libitum* and water was available