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Original Research Article

Effects of dietary alfalfa flavonoids extraction on growth performance, organ development and blood biochemical indexes of Yangzhou geese aged from 28 to 70 days

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ABSTRACT

This experiment was conducted to study the effects of dietary alfalfa flavonoids extraction supplemental level on growth performance, organ development and blood biochemical indexes of Yangzhou geese at the age of 28 to 70 days. Two hundred and forty 21-day-old healthy male geese with similar body weight were randomly distributed into 4 groups with 6 replicates per group and 10 geese per replicate. Geese in the control group were fed a basal diet and the others in the experimental groups (groups 1, 2, and 3) were fed experimental diets supplemented with 150, 300 and 450 mg/kg alfalfa flavonoids extraction (the concentration of it was 81%), respectively. The experiment had 7 days for pre-test and 42 days for formal test. The results showed that the final body weight and average daily intake of group 2 were significantly higher than those of other groups ($P < 0.05$). The average daily gain of group 2 was significantly higher than that in the control group and group 1 ($P < 0.05$). There was no significant difference in feed-to-gain ratio between each group ($P > 0.05$). Pre-slaughter live weight, carcass weight, slaughter rate, semi-eviscerated weight, semi-eviscerated rate, eviscerated weight, eviscerated rate, leg muscle weight and leg muscle rate had no significant difference between each group ($P > 0.05$). The breast muscle weight and ratio of each test group were significantly higher than those in the control group ($P < 0.05$) and the group 2 was the best. The abdominal fat weight and ratio in the group 1 were significantly higher than those in the control group and group 3 ($P < 0.05$) and the tibia weight in the group 2 was significantly higher than that in the control group and group 1 ($P < 0.05$); There were no significant differences in heart weight, liver weight and the gland stomach weight among all groups ($P > 0.05$). Spleen weight in test groups was significantly higher than that in the control group ($P < 0.05$). The bursa weight and muscular stomach weight in the group 2 were significantly higher than those in the control group and group 1 ($P < 0.05$). In serum, total cholesterol, triglycerides, low-density lipoprotein and urea nitrogen in the group 2 were significantly lower comparing with those in the control group ($P < 0.05$). High-density lipoprotein in the group 2 was significantly higher than that in other groups ($P < 0.05$). There were no significant differences in total serum protein, albumin, globulin and albumin/globulin among all groups ($P > 0.05$). Alanine aminotransferase and aspartate transaminase (AST) in groups 2 and 3 were higher than those in the group 1 and control group but not obvious ($P > 0.05$) and alkaline phosphatase (ALP) in groups 1 and 2 was higher than that in the control group and group 3 ($P > 0.05$). It is concluded that alfalfa flavonoids extraction added in dietary feed improve the growth performance, organ development and blood

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biochemical indexes of Yangzhou geese. It is concluded that 300 mg/kg supplemental level of the dietary alfalfa flavonoids extraction is optimal in this experiment.

1. Introduction

Alfalfa (*Medicago sativa* L.) is a high-yield and perennial legume which is regarded as the "King of Grass" in the world (Yu et al., 2014). It was introduced and cultivated all over the world. With rich nutritional value and rich in active substances, utilization of alfalfa resources has become a good prospective projects in the development of forage resources in China which also aroused a growing concern and attention domestic and abroad (Yu et al., 2014). Flavonoids as one of the biologically active ingredient of alfalfa was shown to significantly promote growth, improve carcass quality and enhance immunity in a certain range of additive on livestock (Xiong et al., 2012; Zhu et al., 2009). Alfalfa meal in the diet of laying hens can improve egg quality and yolk color (Xia et al., 2011). With alfalfa flavonoids adding in the diet of mice, the researchers showed that it can significantly improve the growth performance of male mice and the specific and non-specific immune function in mice has improved to some extent (Zhu et al., 2008). Research of flavonoids adding in pigs, mice, chickens and other ruminant animals has been illustrated in some related studies (Zhang et al., 2006; Gao et al., 2011; Liu et al., 2004), whereas the impact on the study of Yangzhou geese has not been reported. Yangzhou geese origin from local geese resources using modern genetic breeding method of new breed with fast early growth, excellent adaptability, good tolerance with crude feed and have fresh meat as well as other advantages. This experiment intended to determine how the supplementation of alfalfa flavonoids extraction influences growth performance, organ development and blood biochemical indexes in Yangzhou geese. This may provide a scientific basis for the rational use of alfalfa flavonoids in the application and efficient development of alfalfa resources.

2. Materials and methods

2.1. Materials

Choosing 1-day-old Yangzhou male geese (available from Yangzhou Goosing Agricultural Science and Technology Co. Ltd in Gaoyou, China), breeding until 21-day-old and then all geese were converted to the experiment. Alfalfa flavonoids: using supercritical CO_2 extraction method by high-speed countercurrent chromatography separation and purification and then measure it by UV spectrophotometry, the concentration of alfalfa flavonoids was 81%. Methods of measurement relating to alfalfa flavonoids can be consulted according to the reference (Cong et al., 2006).

2.2. Experimental design and feeding management

The experiment was conducted at geese field of Yangzhou Goosing Agricultural Science and Technology Co., Ltd which belongs to the teaching practice base of Yangzhou University from April to June in 2015. Two hundred and forty 21-day-old healthy male geese with similar body weight were randomly distributed into 4 groups with 6 replicates per group and 10 geese per replicate. Geese in the control group were fed a basal diet and the others in the experimental groups (groups 1, 2, and 3) were fed experimental diets supplemented with 150, 300 and 450 mg/kg alfalfa flavonoids extraction (81%), respectively. In each experimental group, alfalfa flavonoids were mixed in proportion to the premix and then added in diet with remixing. All geese using methods of indoor online rearing, free feeding with mash diets, enough water and natural light, were treated according to routine immunization program. During 7 days for pre-test, all experimental geese were fed the basal diet at 1 to 2 days, and 1/3 experimental diets with 2/3 basal diets were fed at 3 to 5 days, 2/3 experimental diets with 1/3 basal diets were fed at 6 to 7 days according to suitable proportion. Feeding trial period starts from 28 to 70 days.

Experimental diets were based on corn-soybean raw materials, referring to the US NRC (1994) standards, designing same or similar level of the nutrient on diets, its component and nutrient levels are shown in Table 1.

2.3. Determination of indexes

2.3.1. Production performance indexes

Feed intake and weight gain were recorded weekly from 28 to 70 days post-hatch, and feed was stopped 6 h before weighting; death and cull were recorded at various ages, and the average daily feed intake (ADFI), average daily gain (ADG) and feed-to-gain ratio (F:G) were calculated.

2.3.2. Slaughter performance indexes

At the end of experiment (70 days), 2 Yangzhou geese of average BW from each replicate (selecting 12 geese from each group) were chosen, weighted and slaughtered, measuring carcass weight, eviscerated weight, semi-eviscerated weight, breast muscle weight, leg muscle weight, abdominal weight, tibia weight while calculating the indexes of carcass yield, eviscerated rate, semi-eviscerated rate, breast muscle yield, leg muscle yield and abdominal rate; Carcass yield (%) = 100 × carcass weight/live weight; eviscerated rate (%) = 100 × eviscerated weight/live weight; semi-eviscerated rate (%) = 100 × semi-eviscerated weight/live weight; breast muscle yield (%) = 100 × ambilateral breast muscle weight/eviscerated

Table 1
Composition and nutrient levels of experimental diets at the age of 28 to 70 days (air-dry basis).

Ingredients	Content, %	Nutrient levels[2]	Content, %
Corn	51.50	Metabolic energy, MJ/kg	10.95
Soybean meal	23.00	CP	16.42
Wheat bran	10.00	CF	5.58
Oat grass	8.00	EE	3.07
Limestone	1.50	Ca	0.97
$CaHPO_4$	1.00	P	0.61
Premix[1]	5.00	Met	0.40
Total	100.00	Lys	1.03

[1] The premix provided the following per kg of diets: VA 1, 500 IU, VD_3 200 IU, VE 12.5 IU, VB_1 2.4 mg, VB_2 5.0 mg, VB_6 2 mg, VB_{12} 0.01 mg, nicotinic acid 65 mg, D-pantothenic acid 15 mg, folic acid 0.5 mg, biotin 0.2 mg, choline 15 mg, Fe (as ferrous sulfate) 90 mg, Cu (as copper sulfate) 5 mg, Mn (as manganese sulfate) 95 mg, Zn (as zinc sulfate) 90 mg, I (as potassium iodide) 0.5 mg, Se (as sodium selenite) 0.3 mg.
[2] Metabolic energy was a calculated value, while the others were measured values.