EFFECT OF CITRUS PULP ON PERFORMANCE AND SOME BLOOD PARAMETERS OF BROILER CHICKENS

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ABSTRACT

Using agricultural waste such as citrus pulp in poultry nutrition is an interesting way to reduce feed cost and environment pollution. A total of 120 one day old broiler chicks (Ross 308 strain) were used in a completely randomized design with 3 treatments, 4 replicates and 10 birds in each replicate. Main ingredients of the diets were corn and soybean meal. Three levels of citrus pulp (0, 3% and 6%) were used in experimental diets. There were no difference between birds feed intake, body weight gain and feed conversion ratio at 42 days of rearing period. Citrus pulp at 6% level reduced cholesterol of the birds blood plasma ($P<0.05$).

INTRODUCTION

Citrus fruits are principally consumed by humans as fresh fruit or processed juice, either fresh chilled or concentrated. Citrus fruits contain N (1–2g/kg on a wet basis), lipids (oleic, linoleic, linolenic, palmitic, stearicacids, glycerol, and a phytosterol), sugars (glucose, fructose, sucrose), acids (primarily citric and malic, but also tartaric, benzoic, oxalic, and succinic), insoluble carbohydrates (cellulose, pectin), enzymes (pectin esterase, phosphatase, peroxidase), flavonoids (hesperidin, naringin), bitter principles (limonin, isolimonin), peel oil (d-limonene), volatile constituents (alcohols, aldehydes, ketones, esters, hydrocarbons, acids), pigments (carotenes, xanthophylls), vitamins (ascorbicacid, Vitamin Bcomplex, carotenoids), and minerals, primarily calcium and potassium (Bampidis and Robinson, 2006). Dried citrus pulp (DCP) is a by-product of extracting juice from citrus. It includes a mixture of citrus peel, pulp, and seed as by-product energy concentrate feed for ruminants (Arthington et al. 2002). The nutrient content of citrus BPF is influenced by factors that include the source of the fruit and type of processing (Ammerman and Henry, 1991). Dried citrus pulp is produced in large scale in western parts of Mazandaran province of Iran, therefore, the purpose of this study was to evaluate the effect of citrus pulp on performance and some blood parameters of broiler chickens.

Material and Methods

A total of 120, one-day old mixed-sex broiler chicks (Ross 308) were obtained from a local commercial hatchery on the hatching day. The experimental design was CRD with 3 treatments and 4 replicates with 10 chicks in each replicate. Treatments included 3 levels of citrus pulp (0, 3 and 6 %). The room was lit continuously during the whole experimental period and room temperature was controlled at 32^{o}C from 1-3 d and then gradually reduced by 2-3^{o}C per week to a final temperature of 20^{o}C. All diets were formulated to meet the nutrient requirements according to Ross 308 rearing guideline. The composition and nutrient levels of the citrus pulp is shown in Table 1. Feed and water were provided ad libitum during the whole trial. The experimental period lasted 42 d. The initial body weight mean of chicks (1 day of age) was about 40 g. There was not any mortality throughout the experiment. At 42 d of age, blood sample was collected from a wing vein. To prevent coagulation, blood samples were mixed with EDTA and centrifuged at 3000x g for 10 min. Plasma stored at -20 C until hormone and metabolite analyses were carried out. Plasma glucose concentration was determined as mg/dL using commercial laboratory kits (Zistshimi and parsazmoon) with god-pap method at 546 nm wavelengths.
Triglyceride and cholesterol measured by using commercial laboratory kits (Friedewald et al., 1972; Gordon and Amer, 1977). Data of this experiment were analyzed by analysis of variance using GLM procedures (SAS Institute, 2001). Differences among means were compared by Duncan's new multiple range test (1955). The model of this experiment was as follow:

$$Xij = \mu + Ti + eij$$

Where μ, Ti and eij are overall mean, the treatment and experimental error effects respectively.

Table 1. Composition and nutrient levels of the citrus pulp.

TDN	NFE	Ash	Crude Fiber	Crude Fat	Crude Protein	Dry Matter
73.53	69.32	3.71	12.68	4.43	6.66	93

RESULTS

Results of the study showed that using citrus pulp in broilers diet had not any significant effect on feed intake, body weight gain and feed conversion ratio (Table 2). These findings are in agreement with Oluremi et al. (2006). They reported that sweet orange (Citrus sinensis) rind can be used to replace maize in the diet of broiler up to 15% level without any adverse effect on performance. However, results of the study are in contrast with the findings of Mourao et al. 2008. They reported that incorporating CP (5% to 10%) reduced daily gain by 26% in birds of 10 % citrus pulp treatment ($P<0.05$), and compared with the control treatment, feed intake increased in birds fed with diets with 5% or 10% CP, which resulted in higher feed

conversion ratio in birds fed with diets contained 10% CP. Using citrus pulp in diet at the level of 6 percent reduced cholesterol concentration in plasma, but it did not have any effect on glucose and triglyceride concentration (Table 2). Reduced cholesterol concentration may be due to pectin content of diets. Citrus fruits are a particularly rich source of pectin, which occurs both in the edible portions of fruit and the inedible residues such as peel, rag, and core (Baker 1994). It has reported that pectin reduces pancreatic enzyme activity, which in turn could increase fecal fat excretion (Dutta and Hlasko, 1985).

Table 2. Effect of citrus pulp on the performance and some blood parameters of broiler chickens.

	Feed Intake	Body weight Gain	Feed Conversion Ratio	Plasma Glucose (mg dL^{-1})	Plasma Cholesterol (mg dL^{-1})	Plasma Triglyceride (mg dL^{-1})
T1*	5289	2580	2.05	257	146[a]	42
T2*	5281	2567	2.05	265	141[a]	40
T3*	5273.6	2560	2.06	269	130[b]	39
S.E. M	18.5	12.31	0.01	0.93	0.84	0.71

*T1= 0, T2=3, T3=6 percent citrus pulp.
Means within rows with different superscripts differ significantly ($p<0.05$)

CONCLUSIONS

In conclusion, using citrus pulp up to 6% in broiler chickens (Ross 308 strain) diet did not have any adverse effect on their performance, so it can be used to reduce feed cost and environment pollution.

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