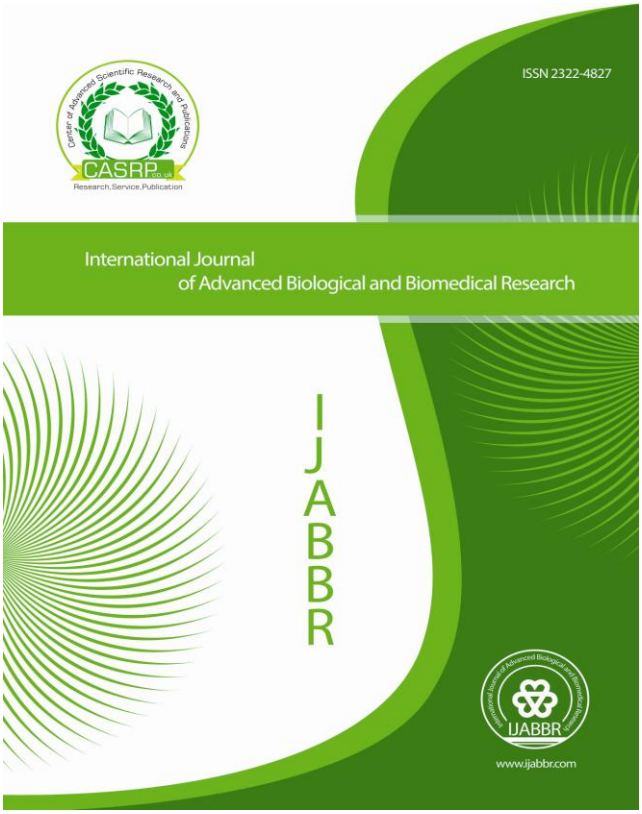

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Original Article **Open Access**

The effects of aqueous extract of onion on performance and some blood biochemical parameters of the Cobb and Ross broilers

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Abstract

This study was carried out to evaluate the effect of onion extract on growth performance, carcass characteristics and some blood metabolites in Ross and Cobb broiler chickens. One hundred sixty, 1-d-old broiler chickens (mean initial weight: 36.5 ± 1 g) of male sex (Ross-308 and Cobb) were randomly conducted as randomized complete design with 4 treatment and 4 replication. The experimental groups included two treatments for Ross strain – control (RC) and the group receiving basal diet + onion extract as 1 % in drink water

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(RO) - and two treatments for Cobb strain –control (CC) and the group receiving basal diet + onion extract as 1 % in drink water (CO). The chickens received food and water freely for 6 weeks. The performance parameters were measured during the experimental period. Blood samplings were performed for determine of blood parameters on 42 days of age. The results showed that use of onion extract lead to significant increase ($p<0.05$) of yield traits in both strain. Maximum daily weight gain (49.97 g), body weight (2135.94 g), and the lowest feed conversion ratio (1.82) were related to RO group. The using of onion extract resulted in decreasing of triglyceride and glucose and increasing of HDL of blood serum in both strain. In general, the results of this experiment showed that onion extract at the level of 1% in drink water can improve the functional and some blood parameters in Ross and Cobb broiler chickens.

Keywords: Onion extract, Growth performance, Blood metabolites, Ross and Cobb broilers.

1. Introduction

In recent years, in order to responding to the increasing needs of the human to animal protein sources, the poultry industry has been developed considerably. This increase in production is necessary for supplying human food (Lee et al., 2004; Hernandez et al., 2004). Widespread and intensive poultry farming has increased the possibility of disease. For over 50 years the use of antibiotics to reduce the incidence of diseases and also help to increase growth and improve producing traits has been widely used in poultry feeding (Konjufca et al., 1997).

Recently, global pattern is shifting from emphasis on production efficiency to public health security. The World Health Organization (WHO) has been introduced resistance to antibiotics as a major problem for public health on a global scale. While excessive and inappropriate use in human medicine might be detected the most important source of risk, but the use of antibiotics in animal husbandry also plays an important role in the occurrence of this problem. Some scientists have been isolated antibiotic-resistant bacterial strains from the environment, products and gastrointestinal system of humans and animals (Ansari and Khatoon, 1999; Miles et al., 2006; Saleha et al., 2009). Hence, there are the evidences exist of possible antibiotic-resistant genes and transfer them from animal microbes to the human-specific microbes.

Medicinal plants due to effective compounds in their tissues including phenols and polyphenols, terpenoids and essential oils, alkaloids, lectins and polypeptides and other compounds applied antibacterial and immune stimulation effects (Giannenas, 2003), digestive process stimulation (Cross et al., 2007; Lee et al., 2003), reducing levels of blood fat and cholesterol (Chowdhury et al., 2002;Konjufca et al., 1997), antioxidant property (Faix et al., 2009; Radwan Nadia et al., 2008) and finally the growth stimulator (Ciftci et al., 2005).

Onion is plant that can be widely used in poultry nutrition due to multiple properties to improve feed efficiency and food safety. Onion, like garlic, belongs to Allium family and has been used widely in human nutrition. Onion contains sulfur compounds, sugar, calcium, sodium and potassium salts, iodine, silica, iron, phosphorus and A, B and C vitamins. It has been reported that onion has the properties of strengthening the immune system. Previous studies suggest that the biological properties of onion are widely related to sulfur-containing compounds (Kurita et al., 1979). Onion has Alliin and Gamma-glutamyl cysteine that are sulfur-containing components belong to the S-alk(en)yl-L-cysteine sulphoxide compounds.

According to the description given above, this experiment was conducted to investigate the effect of onion on the performance and some blood parameters of broilers and replacement onion instead of antibiotics in broiler diets.

2. Materials and methods

2.1. Animals and diet

The experiment was conducted in one of the chicken farming salons of Hamadan city. One hundred sixty, 1-d-old broiler chickens (mean initial weight: 36.5 ± 1 g) of male sex (Ross-308 and Cobb) were randomly conducted as randomized complete design with 4 treatments and 4 replications. The experimental groups included

two treatments for Ross strain – control (RC) and the group receiving basal diet + onion extract as 1 % in drink water (RO) - and two treatments for Cobb strain –control (CC) and the group receiving basal diet + onion extract as 1 % in drink water (CO).The birds were reared in ground cages on the wood chips with dimensions 100 cm × 100cm. The basal diet (Table 1) formulated according to the nutrient requirements (NRC 1994) of broilers based on corn and soybean meal: starter (1 to 21 d) and grower (22 to 42 d).The lighting program included of 23h light plus 1h of darkness. The birds were raised for 6wk and had free access to feed and water throughout the entire experimental period. The house temperature was maintained at 34ºC during the first week, and it was decreased by 3ºC in following weeks until it was stabilized at 22ºC.

2.2. Preparation of onion extract

First, the bulbs of onion layers were separated and washed. Second, the onion bulbs were put in particular container, and kept in freezer at -20°C for two days. This leads to the comfortably destroy of the cells and make it easier for extraction. After 48 h the onion bulbs were removed from the freezer and were defrosted in 30 minutes. Finally, the aqueous extracts were obtained with a filter and poured into particular containers (Wilson et al., 1997).

Table 1
Composition of experimental diet

diet items Ingredient, g/kg	Starter diet (0-21	Growth diet (21- 42
Corn	61.51	69.06
Soybean meal	28.75	22.49
Fishmeal	6.00	4.83
Soybean oil	0.94	0.00
D.C.P	0.66	1.23
Shell powder	1.19	1.58
Salt	0.37	0.26
Vitaminpremix1	0.25	0.25
Mineral premix2	0.25	0.25
DL-Methionine	0.09	0.02
Metabolizable energy (kcal/kg)	3000	3000
Crude protein(g/kg)	21.56	18.70
Calcium (g/kg)	1.00	1.20
Available phosphorus (g/kg)	0.43	0.48
Digestible Methionine(g/kg)	0.48	0.37
Digestible Lysine(g/kg)	1.20	1.00
Digestible Methionine +	0.82	0.67

1-Ingredients per kg: Mg, 60 g; Fe, 80 g; Cu, 10 g; Zn, 50 g; Co, 2 g; I, 1 g,
2- Ingredients per kg : vitamin A, 1000,000 IU; D3, 1500000 IU; E, 15000 IU; K, 3g; B1 2g; B2, 4 g; B6, 3g; B12, 0.015 g; pantothenic acid, 10 g; nicotinic acid, 2 g; folic acid, 1 g; choline, 250g ; Se, 100 g

2.3. Performance

Body weights and feed intake of birds were measured at d 1, 21, and 42 of age and daily body weight gain and feed conversion ratio (FCR) were computed. Mortality was recorded as it occurred and was used to adjust the total number of birds to determine the total feed intake per bird and FCR.

2.4. Carcass characteristics

At the end of experimental period after 12h of fasting, three birds from each pen were killed by serving the jugular vein and carotid artery on one side of the neck and allowed to bleed. Then, weight of different parts of

body (such as breast, thighs, liver, heart, pancreas and abdominal fat) measured with digital scale (with an accuracy of 0.01g).

2.5. Blood biochemical parameters

Blood samples were collected in non-heparin tubes by puncturing the brachial vein. Then the blood sample was centrifuged at 5000 rpm for 5 minutes to separate the serum (SIGMA 4 - 15 Lab Centrifuge, Germany). Individual serum samples were analyzed for glucose, total protein, triglycerides, high-density lipoprotein (HDL), low - density lipoprotein (LDL) and cholesterol. A Pars Azmoon Kit was employed to perform the tests(Allison Auto-analyzer set, USA).

2.6. Statistical analysis

Statistical analysis of data related to measured parameters was carried out using SAS 9.1 statistical software. The significance of differences between means was compared by using of the Duncan's multiple range tests of SAS. Significance was declared at $P \leq 0.05$ for all variables measured.

3. Results

3.1. Daily weight gain and average live weight

Data analysis related to daily weight gain showed that there was significant ($P<0.05$) difference between experimental treatments in grower and total periods (Table 2). During the total period, the highest and the lowest daily weight gain related to RO and CC treatment respectively. The difference between Ross and Cobb groups with their control treatments was significant, but the difference between control groups was not significant. In general, the using of onion in both strains of broiler improved daily weight gain, but it seems that this effect has been more in Ross strain. There was the same trend for average live weight at the end of growth period (Table 3). The highest live weight was related to RO group. The ratio of body weight gain was more in RO (3.13%) than CO group (2.90%).The reason of weight gain caused by onion extract can be due to various compounds in onion. Onion has antibacterial and antifungal properties. It has been reported that onion extract was very effective against Gram-positive bacteria, dermatophyte fungi and growth and production of aflatoxin by *Aspergillus* (Zohri et al., 1995). In addition to the inhibitory effects against pathogenic bacteria, it has been shown that onion stimulates the growth of beneficial microorganisms. Onions contain Fructooligosaccharides(FOS) that belong to prebiotic components. The components are non-digestible substances that are fermented in the body by bifidobacteria. These compounds help to health maintaining of digestive system and colon (Gibson, 1998). Another reason can be the increase of feed intake. As can be seen in Table 4, onion extract increased feed consumption in chickens.

Aji et al. (2011) fed values of 25, 50 and 100 mg onion per day to broiler chickens and observed that body weight increased with 50 and 100 mg. Al-homidan (2005) used 2 and 6% of onion dry powder in diet of broiler chickens. At the end of the period the birds that received 2%onion dry powder had more weight. Goodarziet al. (2013& 2014) also reported improvement in weight gain of chickens that had received 10 and 30 grams of fresh onion in diet.

3.2. Daily feed intake

Data analysis showed that there was a significant differences in the initial period, growth period and total period ($P<0.05$). Overall, the onion extract caused to increasing in *daily feed intake* in both broiler strains. Although differences of daily feed intake for groups that received onion extract were not significant, but it's increasing proportion in Cobb was more than Ross. Control treatments did not showed significant difference (Table 4).Aji et al. (2011) also observed increasing in feed intake of broiler chickens by using 100 mg of dried onion powder soluble in water. Al-homidan (2005) reported that 2% of dried onion in the diet had no effect on feed intake, but the level of 6% reduced feed intake in broiler chickens. Goodarzi et al. (2013, 2014) reported similar results with our experiments.

Table 2
The effects of treatments on daily weight gain (g).

Duration	Treatments				SEM	P value
	RC	RO	CO	CC		
1-21 days	24.98	21.50	24.63	23.76	0.266	0.338
21-42 days	71.88^{c}	74.95^{a}	73.60^{b}	71.65^{c}	0.382	0.000
1-42 days	48.43^{bc}	49.97^{a}	49.11^{ab}	47.70^{c}	0.267	0.004

^{abc,} averages within each row together with dissimilar letters are significantly different. (P<0.05). Ross Control (RC), The Ross Chickens receiving the basal diet + 1% onion extract (RO), Cobb chickens receiving the basal diet + 1% onion extract (CO) and Cobb Control (CC).

Table 3
The effects of treatments on average weight gain (g).

Duration	Treatments				SEM	P value
	RC	RO	CO	CC		
21 days	561.57	561.99	554.17	535.40	5.95	0.330
42 days	2070.94^{bc}	2135.94^{a}	2099.77^{ab}	2040.62^{c}	11.19	0.004

^{abc,} averages within each row together with dissimilar letters are significantly different. (P<0.05). Ross Control (RC), The Ross Chickens receiving the basal diet + 1% onion extract (RO), Cobb chickens receiving the basal diet + 1% onion extract (CO) and Cobb Control (CC).

Table 4
The effects of treatments on daily feed intake (grams per day).

Duration	Treatments				SEM	P value
	RC	RO	CO	CC		
1-21 days	36.44^{b}	36.96^{ab}	37.34^{a}	36.55^{ab}	0.134	0.077
21-42 days	143.54^{b}	144.80^{a}	145.13^{a}	143.78^{b}	0.204	0.001
1-42 days	89.99^{b}	90.88^{a}	91.26^{a}	90.37^{b}	0.142	0.000

3.3. Feed conversion ratio (FCR)

Results showed that there was no significant difference in the early period, but during the growing period and total period was significant difference (P<0.05) (Table 5). The best and the worst feed conversion ratio related to CC and RO groups in the whole growing duration, respectively. Onion extract improved the feed conversion ratio in both broiler strains. This using of onion extract improved feed conversion ratio in both strains of broilers. It can be due to the effect onion extract on body weight. Therefore, that reason that has been declared for weight gain due to the consumption of onions is true for FCR. Aji et al. (2011) also reported improving feed conversion ratio in all birds that had received the onions. Goodarziet al. (2013) also reported improving in feed conversion ratio by consuming 10 to 30 grams of fresh onion in the diet.

Table 5
Effects of treatments on feed conversion ratio FCR.

Duration	Treatments				SEM	P value
	RC	RO	CO	CC		
1-21 days	1.46	1.48	1.52	1.56	0.019	0.322
21-42 days	1.997^{ab}	1.932^{c}	1.972^{b}	2.01^{a}	0.008	0.001
1-42 days	1.860^{ab}	1.820^{b}	1.858^{ab}	1.895^{a}	0.009	0.038

3.4. Carcass characteristics

Data of carcass characteristics listed in Table 6. Comparison of means by Duncan indicated that there was significantly difference between treatments according to breast weight and abdominal fat weight traits (P<0.05).

Other traits reported in the table are statistically not significant. Onion extract led to breast weight gain in both broiler strains which the maximum amount related to RO and CO groups. There are no significant differences between the control groups. In compare with control, two groups that received onion extract has lower abdominal fat and in general, the amount of abdominal fat in Cobb strain was less than Ross strain. The lowest value of this parameter corresponded to the CO group. Onion extract increased breast weight and reduced abdominal fat. Carcass efficiency also increased non-significantly. Non-significant improvement in the carcass efficiency can be due to effects of onion compounds on broiler chickens. Weight loss of digestive tract caused by the removal of harmful bacteria can be one of the possible causes (Gibson, 1998). The improving of immune system can increase muscle growth (Lancaster and Shaw, 1989). Goodarzi et al. (2013) reported that the using of 30 gr/Kg fresh onion in diet improved some immune system parameters such as bursa and spleen weight.

The using of onion extract in diet reduced abdominal fat in both strains. Sebastian et al. (1979) reported that onion reduced significantly the amount of triglycerides in the liver. Goodarzi et al. (2013) showed that the using of 30 gr/Kg onion reduced triglyceride concentration in blood serum. Suresh and Srinivasan (1997) also found that 3% onion powder reduced blood lipids, lipid peroxides and cholesterol. Onion effects attributed to its sulfur compounds that oxidize free thiol compounds or bind to protein and NADPH. These compounds are essential for the synthesis of fat in the body. Plants can affect the fatty deposits in the body by making changes in the mechanisms involved in lipid metabolism and antioxidant effects. Some active components in plants affect lipid metabolism by moving fatty acids, increase using of fat and reduce weight of abdominal fat (Cross et al., 2007). The potential of plant derivatives in reducing fat deposition in the abdominal area can also be attributed to their role in enhancing the immune response (Dong et al., 2007).

Table 6
Effects of treatments on carcass characteristics at 42 days of age.

	Treatments					
Parameters	**RC**	**RO**	**CO**	**CC**	**MSE**	**P value**
Carcass(g)	1518.46	1586.20	1541.55	1493.51	16.560	0.246
Carcass Efficiency (%)	73.33	74.24	73.45	73.17	0.607	0.940
Breast (g)	454.70[b]	492.25[a]	491.82[a]	457.97[b]	6.876	0.037
Breast (%)	21.95	23.05	23.43	22.45	0.266	0.217
Thighs (g)	448.18	481.11	469.70	429.04	10.377	0.314
Thighs (%)	21.64	22.53	22.36	21.00	0.448	0.650
Heart (%)	0.690	0.718	0.705	0.665	0.021	0.863
Liver (%)	3.56	3.21	3.38	3.51	0.119	0.770
Pancreas (%)	0.303	0.320	0.295	0.270	0.017	0.750
Abdominal fat (%)	2.63[a]	2.25[b]	2.04[c]	2.29[b]	0.060	0.000

3.5. Blood serum metabolites

There was a significant difference between treatments based on Triglyceride concentrations, HDL and glucose ($P<0.05$), but the difference was not significant in relation to total cholesterol and LDL (Table 7). Onion extract reduced the blood serum triglycerides of broiler, so that the least related to the RO and CO groups. The difference between these two groups was not significant. Although there was no significant differences in total cholesterol, but also onion extract reduced its concentration. In reverse, onion extract increased HDL that more reduction related to Cobb. The highest and the lowest HDL related to the RO and RC groups, respectively. Blood glucose level was also affected by treatments. Onion extract decreased it in both strains of broiler in compared to the control groups. Minimum and maximum values related to CO and the RC, respectively. Suresh and Srinivasan (1997) found that 3% of onion powder in diet reduced the lipid, fatty peroxides and cholesterol (particularly LDL and VLDL) of blood. Also, Al-homidan (2005) and Sebastian et al. (1979) recorded reduction of serum cholesterol in their experiments due to consumption of onion. Similar to our results Goodarzi et al. (2013) reported a reduction in triglyceride and glucose and enhancement in HDL cholesterol offered diets containing fresh onion bulbs in

comparison with broilers fed basal diet. In contrast to the above experiment, Sklan et al. (1992) did not observed the effect of onion on liver cholesterol.

Using of onion extract in the diet decreased concentrations of Glucose in both strains of broilers. It was distinguished that onion consumption in high level reduced glucose level. Organic sulfur compounds including S - methyl cysteine sulfoxide (SMCS) and S-allyl cysteine sulfoxide (SACS) related to significant improvements in body weight reduction, high blood fat, low protein and glycogen of liver and other features related to diabetes in rats. Application 200 mg/kg per day of SMCS and SACS had similar results with insulin therapy, but without the negative side effects of stimulation in cholesterol synthesis (Sarica et al., 2005). The results of present study were consistent with the results of Al-homidan (2005).

Table 7
Effect of treatments on blood serum metabolites.

Duration	Treatments				SEM	P value
	RC	RO	CO	CC		
Triglyceride	126.25 ^{a}	113.20^{b}	109.25^{b}	117.50^{ab}	2.15	0.0167
Cholesterol	139.00	131.50	133.50	138.00	4.79	0.944
LDL	39.50	37.00	34.50	44.00	3.16	0.798
HDL	80.75^{b}	91.75^{a}	90.00^{a}	81.50^{b}	1.46	0.005
Glucose	88.75^{a}	77.50^{bc}	74.00^{c}	85.00^{ab}	23.13	0.035

4. Conclusion

The results of this experiment showed that one percent onion extract in drinking water can improve performance parameters. Also, it can reduce blood triglyceride and glucose and increase HDL cholesterol in both Ross and Cobb broilers.

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