Effect of the *Heracleum persicum* and *Echinacea angustifolia* levels on performance in of male Japanese quail

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Abstract

This research was conducted to investigate the effects of the combined use of *Heracleum persicum* and *Echinacea angustifolia* levels on performance, carcass characteristics and blood chemical parameters in of male Japanese quail over a period of 42 days. In this study, 400 one day old male Japanese quail chicks are used in a completely randomized manner. 5 experimental treatments and 4 replications are performed on 20 quail chicks in each replication. Treatments in this study include: 1) The basal diet, 2) The basal diet + 0.25% Heracleum and 0.25% Echinacea, 3) The basal diet + 0.5% Heracleum and 0.5% Echinacea, 4) The basal diet + 0.75% Heracleum and 0.75% Echinacea, 5) The basal diet + 1% Heracleum and 1% Echinacea. Related characteristics, including feed intake, weight gain, and feed conversion ratio are measured weekly. The results showed that in terms of feed intake, the difference among treatments was not significant. However, in terms of weight gain, there was a significant difference among treatments at the third and sixth weeks. In the sixth week, the highest weight gain was observed for the treatment containing one percent Heracleum and one percent Echinacea, which presents a significant difference with the control treatment. The feed conversion ratio showed notable differences among treatments at 3rd, 5th and 6th weeks; so that, in the fifth and sixth weeks, the treatments containing one percent Heracleum and one percent Echinacea had the lowest feed conversion ratio. The results prove that the compounds contained in Heracleum and Echinacea, have improved the average of weight gain and feed conversion ratio by accelerating digestion and shortening the transit time of food from the gastrointestinal tract. There was no significant difference among the treatments and the control treatment regarding blood parameters and carcass characteristics.

Keywords: *Heracleum persicum*, *Echinacea angustifolia*, Performance, Male Japanese quail

Introduction

The poultry sector is an important part of the production and consumption of animal protein in developed and developing countries; over the past decade, about half of the meat production come from to this sector (Mohammadian and Mehrabanian, 1999). Animal science researchers have always made great efforts to increase production in the shortest time and with minimum side effects (Angas et al, 2015). In recent decades, much attention has been focused on the use of dietary supplements in the diet of breeding animals to evaluate its products (Mehdizadeh et al, 2004). Nowadays, due to antibiotic resistance in poultry and the effects on antibiotic resistance in poultry meat consumers finding a suitable replacement is more pertinent than before. On the other hand, the new methods of tracking antibiotic residues in carcasses increase the motivation of producing meat without antibiotics. Therefore, scientists are looking for alternatives that are safe and appropriate in poultry nutrition (Emami et al, 2013, Yesuf et al, 2017). Herbs, spices and plant extracts contain several active components with intrinsic biological activities on animal physiology and metabolism (Oko, 2011; Oko et al, 2016).

Extracts and plant seeds are used in seasonal foods and beverages and their beneficial effects are known for centuries (Emami et al, 2013). The increased use of medicinal plants in animal nutrition is the result of their positive properties like: antiinflammatory properties, antiseptic, sedative, bactericidal, fungicidal, antiviral, antioxidant capacity, growthpromoting efficacy, dietary palatability, gut functions, immune stimulating effects, stimulation of the secretion of digestive enzymes and absorption of nutrients (Ertast et al, 2005; Cross et al, 2007; Steiner, 2009; Fallah & Mirzaei, 2016).

Plant-derived compounds are usually known because of their flavoring properties. But these plants also have antimicrobial, antiviral, antifungal, and antioxidant properties confirmed in several experiments. Gastrointestinal microflora, intestinal morphology, gastric emptying and gastrointestinal activity are expected to be affected by these plant compounds. Heracleum is one of those useful plants. In addition to microbial and strong disinfectant, it also plays role in digestion process and excretion of toxins. Echinacea is also effective in the treatment of plant infections, and as a result, improving the growth and immunity of the body (Nasir, 2008). Therefore, it seems that a combined use of Heracleum and Echinacea in quail diet can affect the performance and carcass characteristics.

Materials and methods

This project was performed on 400 male, one day old, quail chicks in five experimental treatments. Each treatment consists of 4 replications in which each consisted of 20 quail. Initial mean body weight was 7.5 grams. Basal composition of the diet was balanced based on 3,000 kcal of energy, 22.5% protein, 1% calcium, 0.5% phosphorus and 0.16% sodium. Chemical composition of food materials is obtained according to the system (AOAC, 1990); and diets were adjusted based on the achieved chemical composition. Treatments in this study include:

1) The basal diet
2) The basal diet + 0.25% Heracleum and 0.25% Echinacea
3) The basal diet + 0.5% Heracleum and 0.5% Echinacea
4) The basal diet + 0.75% Heracleum and 0.75% Echinacea
5) The basal diet + 1% Heracleum and 1% Echinacea

In this research, live weight gain, feed intake and feed conversion ratio were measured in each of the treatments. The following subsections describe the parameters.

Llive weight

At the end of each week, each row of caged chickens was separately weighed 3 hours after the cessation of the seed. Live weight was found from the weight each box, at the end of every period, divided by the number of birds.

$$Average\ Live\ Weight = \frac{Weight\ of\ each\ box\ at\ the\ end\ of\ each\ period}{Number\ of\ birds\ in\ each\ box}$$

Feed intake

Food intake of each box was measured on a daily basis. The average intake for each chicken would be:

$$Average\ Feeding\ Intake = \frac{Food\ intake\ of\ each\ box\ at\ the\ end\ of\ each\ period\ (grams)}{Number\ of\ birds\ in\ each\ box}$$

Feed conversion ratio

As mentioned previously, the diet for each treatment designated separately and body weight of all chickens at the end of each period (initial and growing) was determined. Based on the above data, feed conversion ratio for each treatment is calculated using the following relation:

$$Feed\ Conversion\ Ratio\ (Weekly) = \frac{Food\ intake\ at\ the\ end\ of\ each\ period\ (grams)}{Weight\ gain\ at\ the\ end\ \ of\ each\ period\ (grams)}$$

Carcass characteristics

At the age of 45 days after being weighed, two birds of each experimental unit, that have the least weight difference with average weight of the unit, were selected and numbered. A 12 hours of starvation before slaughter was considered.

Blood parameters

At the end of the experiment period (42 days), two birds from each experiment replication were selected and transferred to the veterinary laboratory. Blood samples are taken from underneath the wixg of the bird and desired parameters were measured.

Data analysis

All data collected during the experiment were analyzed using Excel software. Calculations for the average feed intake, weight gain, feed conversion ratio and density of hematological parameters are performed for the different treatments. Data analysis is performed using SAS software. Comparison of means is also conducted by using Duncan's multiple range tests at the significance level of 0.05. The project statistical model is:

$$X_{ij} = \mu + T_j + e_{ij}$$

X_{ij}: Observation of the i^{th} iteration in the j^{th} treatment

μ: Mean value of all the data

T_j: Effect of the j^{th} experimental treatment

e_{ij}: Effect of experimental error

Results and discussion

The results of feed intake by quail chicks during the breeding weeks are shown in Table 1. Based on the table, there was no significant difference in feed intake among treatments ($p>0.05$). The results of this study show that adding Heracleum and Echinacea do not have a positive effect on the palatability of the diet. Table 2 represents the results of the weight gain in quail chicks during breeding weeks. As shown in the table, the difference in weight gain among treatments is significant in the third and sixth weeks ($p<0.05$).

Table 1. The effect of treatments on feed intake (grams)

Treatment	Breeding Period (days)					
	7-14	14-21	21-28	28-35	35-42	The Period
T1	75.60	125.56	147.26	200.47	226.36	831.01
T2	76.04	126.78	147.61	201.25	214.64	825.71
T3	77.08	126.26	147.78	200.81	223.82	834.25
T4	76.56	125.73	147.72	199.93	218.66	827.01
T5	75.07	126.35	148.75	200.02	226.71	832.41
SEM	1.38	2.15	2.11	2.44	6.31	9.81
P-value	0.312	0.928	0.889	0.933	0.066	0.706

T1: The basal diet, T2: The basal diet + 0.25% Heracleum and 0.25% Echinacea, T3: The basal diet + 0.5% Heracleum and 0.5% Echinacea, T4: The basal diet + 0.75% Heracleum and 0.75% Echinacea, T5: The basal diet + 1% Heracleum and 1% Echinacea

Table 2. The effect of treatments on weight gain (grams)

Treatment	Breeding Period (days)					
	7-14	14-21	21-28	28-35	35-42	The Period
T1	35.25	49.77^{ab}	41.72	36.00	22.50^{c}	234.37
T2	35.70	53.75^{a}	37.30	34.75	30.75^{ab}	234.50
T3	38.80	41.35^{c}	48.35	43.75	27.25^{bc}	240.75
T4	38.60	45.82^{ab}	41.32	44.25	26.00^{bc}	241.62
T5	39.42	45.17^{bc}	42.15	32.50	34.50^{a}	235.00
SEM	3.32	4.58	8.96	7.87	3.49	5.21
P-value	0.296	0.017	0.554	0.092	0.002	0.158

1: The basal diet, T2: The basal diet + 0.25% Heracleum and 0.25% Echinacea, T3: The basal diet + 0.5% Heracleum and 0.5% Echinacea, T4: The basal diet + 0.75% Heracleum and 0.75% Echinacea, T5: The basal diet + 1% Heracleum and 1% Echinacea,

In the third week, the treatment containing 0.25% Heracleum and 0.25% Echinacea had the highest weight gain; however, the difference was not significant compared to the control treatment. The lowest weight gain in this week is related to the treatment containing 0.5% Heracleum and 0.5% Echinacea.

In the sixth week, the highest weight gain was observed for the treatment containing 1% Heracleum and 1% Echinacea, which was not a significant difference with the control treatment. Also, in this week, the control treatment has

the lowest weight gain. It seems that these herbal plants act as stimulant of digestion. They can improve food digestion and growth by improving the balance in the intestinal microbial ecosystem and stimulating secretion of endogenous enzymes. The results of the feed conversion ratio in quail chicks during different breeding weeks are shown in Table 3. As shown in the table, the conversion ratios have notable differences in the third, fifth and sixth weeks ($p<0.05$).

Table 3. The effect of treatments on feed conversion ratio

Treatment	Breeding Period (days)					
	7-14	14-21	21-28	28-35	35-42	The Period
T1	2.15	2.53^{bc}	3.70	4.46^{bc}	10.36^{a}	3.50
T2	2.13	2.37^{c}	4.26	5.96^{ab}	7.11^{bc}	3.50
T3	1.99	3.07^{a}	3.07	4.72^{bc}	8.23^{bc}	3.42
T4	2.00	2.59^{bc}	3.83	4.68^{bc}	8.49^{b}	3.42
T5	1.91	2.80^{ab}	3.55	4.20^{c}	6.59^{c}	3.47
SEM	0.178	0.246	0.987	0.892	1.16	0.074
P-value	0.317	0.009	0.596	0.038	0.003	0.416

T1: The basal diet, T2: The basal diet + 0.25% Heracleum and 0.25% Echinacea, T3: The basal diet + 0.5% Heracleum and 0.5% Echinacea, T4: The basal diet + 0.75% Heracleum and 0.75% Echinacea, T5: The basal diet + 1% Heracleum and 1% Echinacea,

In the third week, the treatment containing 0.5% Heracleum and 0.5% Echinacea, showed a significant difference with the control treatment ($p<0.05$) and had the highest conversion rate. The lowest, and therefore the best, conversion ratio was related to the treatment containing 0.25% Heracleum and 0.25% Echinacea, although the difference with the control treatment was insignificant.

In the fifth and sixth weeks, the best feed conversion ratio is related to the treatment containing 1% Heracleum and 1% Echinacea. It seems Heracleum and Echinacea in the diet improve the average weight gain and feed conversion ratio by accelerating the food digestion and shortening the passage time of the digestive tract. Medicinal plants affect the performance of broilers in different aspects. In these plants there are effective substances such as Cinnamaldehyde and Capsaicin. These substances can have stimulating effects on increasing the secretions of digestive latexes from organs such as the pancreas and liver. Sufficient secretion of these latexes leads to better digestion, absorption and metabolism of nutrients. The result would be reflected as improvement in the performance efficiency (Ebrahimi, 2011).

The results of hematologic parameters are shown in Table 4. As seen in the table, hematologic parameters are not significantly different among the experimental treatments ($p>0.05$). The results related to carcass characteristics of quail chicks are in Table 4. As seen in the table, carcass characteristics are not significantly different among the experimental treatments ($p>0.05$).

Table 4. The effect of treatments on blood parameters and carcass characteristics weight

Treatment	Total Protein	Chol	TG	FBS	Breast	Thigh	Heart	Liver	Carcass weight
T1	2.96	298.50	96.88	278.25	67.86	23.30	3.12	12.46	165.65
T2	2.76	312.13	112.38	280.50	67.77	23.27	2.98	12.45	160.54
T3	2.89	277.38	113.75	273.37	67.53	23.05	2.93	12.36	159.71
T4	2.76	286.75	89.50	266.75	67.44	23.21	2.98	12.44	160.22
T5	2.55	244.63	95.00	280.75	67.40	23.17	3.03	12.44	160.21
SEM	0.244	38.66	22.78	12.09	0.342	0.251	0.176	0.219	5.41
P-value	0.213	0.193	0.479	0.458	0.757	0.461	0.301	0.961	0.627

T1: The basal diet, T2: The basal diet + 0.25% Heracleum and 0.25% Echinacea, T3: The basal diet + 0.5% Heracleum and 0.5% Echinacea, T4: The basal diet + 0.75% Heracleum and 0.75% Echinacea, T5: The basal diet + 1% Heracleum and 1% Echinacea,
TG: triglyceride, FBS: ,fast blood sugar, Chol: cholesterol

Conclusion

The results of this study indicate that the combined use of Heracleum and Echinacea do not have a positive effect on the feed intake. But the effective ingredients in these compounds can stimulate and produce endogenous enzymes, accelerate the food digestion, and equilibrate intestinal microbial ecosystem, and therefore improve the average weight gain and the feed conversion ratio.

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