Effect of using ginger, red and black pepper powder as phytobiotics with Protexin® probiotic on performance, carcass characteristics and some blood biochemical on Japanese quails (*Coturnix japonica*)

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Abstract

This experiment was conducted to evaluate the feeding values of ginger, red and black pepper powder with protexin on performance of Japanese quails. A total 240 ten-days-old male Japanese quails with an average weight of 19±5 g were divided into 8 treatments with 3 replicates as randomized factorial design. The quails were fed by basal diet as control diet, 2% ginger, 2%red pepper 2% black pepper powder with or without protexin probiotic respectively. At the end of trial for carcass evaluation 2 birds form each group were slaughtered. Also, some parameters such as feed intake, body weight gains, and feed conversion ratio were calculated and compared together. Some blood parameters such as cholesterol, triglyceride, high density lipoprotein, low density lipoprotein of quail's blood was determined. In conclusion it seems that inclusion of ginger, red and black pepper powder in quails' diet at level of 2% may be useful and have significant effects on performance and blood biochemical on Japanese quails.

Introduction

Ginger, *(Zingiber officinale l*) is one of the most widely used spices and it is a common additive in large number of compounded feeds and beverages due to its flavor and pungency.[1] The rhizome of this plant is one of the most commonly used medicinal herbs as well as one of the most commonly used condiments in Chinese cuisine. Folk people have long used the soup of ginger root to warm the human body in winter. Though spicy and hot in nature, the rhizome of ginger has been used to treat symptoms and signs including pale feature, cold extremities.[2,3] Several pharmacological effects of the Zingiber plant had been reported such as antiulcer effect, antioxidant effect, potent antibacterial activity, potent antifungal activity and anti-helminthicactivity.[4]

Pepper species, commonly used in diet and traditional medicine, were assessed for their antioxidant potential. Black pepper (*Piper nigrum l*) is flowering vine in the family *Piperaceae* genus *Piper.*[5] Piperine is one of compound of black pepper which has anti-ache effect.[6] Piper nigrum has medicinal uses and have been common medicines for various disorders of humans in traditional Indian families.[7] There are anti-bacterial and anti-oxidant effects in medicinal plants.[5,6,8] Redpepper (*Capsicum annuum l*) comes from fruits in the capsicum family. Antimicrobial peptides from red pepper are very efficient in inhibiting growth in human and plant pathogenic bacteria and fungi. The active material capsaicin, causing the hotness, is an odorless white alkaloid soluble in hot water, ethyl and methyl alcohols and acetone.[9] It is rich in vitamin C and pro-vitamin A and B; and it is very high in potassium, magnesium and iron. The substances that give hot peppers their heat is capsaicin and several related chemicals collectively called capsinoids.[10] Many researchers proved an increase in BW and decrease in FCR, when using these herbal plants in broilersdiets.[2,11-14]

Protexin is one of the probiotics used in poultry feed stuffs.[15] Protexin is a multi-strain probiotic containing live microbes to establish, enhance or reestablish essential micro-flora in the gut. All the microorganisms in the protexin are naturally occurring and have been isolated from a wide range of feed, plant, animal, bird and human sources.[16,17] Protexin can be used in a wide range of circumstances, either to improve the general health of animals, address specific problems or to maximize animal's performance. Under general conditions protexin has been promoted to improve health naturally, stimulate appetite, aid in establishment of gut flora in immature animals like day old chicks, calves, lambs, kids, kittens and it uses for optimize digestion of feed and reduce stress.[18-20] For evaluation the feeding values of ginger, red and black pepper powder with protexin on performance of Japanese quails, the main purpose of this study was carried out to evaluate the effect of 2% dietary level of ginger, red and black pepper powder as phytobiotics and protexin probiotic on performance, carcass characteristics and some blood biochemical parameters in Japanese quails.

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Materials and Methods

This experiment was carried out at the aviculture farm of Shahrekord, Iran. All experimental procedures were in accordance with established standards for the care and use of animals for research purposes.

A total of 240 ten days old male quail chicks with an average weight of 19.50 g were divided into 8 treatments and were further subdivided into 3 replicates with 10 birds on each. Herbal were purchased from animal feed factory in Tehran-Iran and they were blended to give a fine powder. Feeding ingredients includes corn and soybean meal were analyzed in the lab for determine amount of dry matter, crude protein, calcium, phosphorus and its crude fiber with association of official analytical chemists.[21] The basal diet was balanced on the basis of corn and soybean meal as recommended by nutrition research council.[22] The treatments were divided as basal diet with no protexin and herbal powders kept as control, and for others 2% ginger, 2% red pepper and 2% black pepper powder with (P_1) or without (P_0) (200 g.kg) protexin were used respectively. The compositions of basal diet are shown in Table 1. Diets and fresh water were provided *ad-libitum* during the experimental period.

The live body weight gains and feed consumption of quails were measured individually; feed conversion ratio was calculated weekly. At the end of experimental

period, 4 birds form each replicate (totally 96 male quails) were slaughtered for determination of carcass traits. Also, dressing percentage was calculated free from giblets and some organs were weighed separately as percentage of carcass weight.

After 12 h of fasting, blood samples were taken from the brachial vein from four birds per replicate and stored at refrigerator at 4°C. Individual serum samples were analyzed for glucose, cholesterol, triglyceride, HDL and LDL by an automatic biochemical analyzer following the instructions of the corresponding reagent kit (Pars Azmoon Co., Teheran, Iran).

The statically model was:

$$Yijk = \mu + \alpha i + \beta j + (\alpha + \beta) ij + eijk$$

where Yijk = average effect observed, μ = total average, αi= effect of herbalpowders,ßj = effect of protexin, (α +ß) ij = interactions (herbals × protexin), eijk = effect of errors. The general liner model (GLM) procedure of SAS software was used for data analysis of variance as completely randomized design.[23] The significant difference among the mean were compared by (Duncan's 1995) multiple range tests.

Results

Data showed that use of protexin and herbals increased feed intake (g) significantly ($P<0.05$) compared to control (Table 1). Body weight (g) was higher significantly when the birds fed by protexin and herbals compared to control. Also feed conversion ratio was lesser in protexin and herbals group and there were significant differences compared to the control ($P<0.05$).

According to the Table 2, the carcass percentage had increased by using herbals and protexin. The breast weight percentage was changed no significantly by using experimental diets. Drumstick weights percentage also were tended to increase by using herbals and protexin and they were at the lowest on control. As result was relevant from Table 2 there were no significant differences between treatments about intestine and gizzard percentage.

Data from Table 3 showed that glucose levels tended to increase by using herbals and protexin. There were significant differences among treatments for cholesterol, triglyceride, HDL and LDL levels. Data showed that cholesterol, triglyceride and LDL were decreased by using herbals and protexin but HDL were tended to increase were quails fed by herbals and protexin.

Discussion

In the present study, protexin and herbals supplementation had significant effects on the measured values in growing Japanese quails. The usage of protexin and herbals together was significant influences on feed intake, body weight, feed conversion ratio and carcass yield. These results agree with the Vahdatpour *et al.*[24] who indicated that consumption of symbiotic (Protexin + Fermacto) were more effective than other groups in feed intake, body weight and feed conversion ratio of Japanese quails. Balevi *et al.*[25] showed that diet supplementation with probiotic could improve feed intake and feed conversion ratio. Many researchers showed that beneficial effects of herbal or active substances in animal nutrition may include the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune response and antibacterial, antiviral, antioxidant and anti-helminthic actions.[26-28] Parreira[29] has showed that dietary supplementation of protexin increased growth performance and decreased mortality in birds.

In Shahverdi *et al.*[9] study the birds that fed supplemented diets with hot pepper showed improved feed conversion ratio. They mentioned that, it might be due to its

Table 1.The effects of herbals and protexin on performance of Japanese quails.

Treatments*	FI (g)**	BW (g)	FCR
Herbals			
Control	19.51^{c}	6.70^{ab}	2.91
Ginger	20.20^{c}	6.80^{ab}	2.97
Red pepper	21.14^{b}	6.79^{ab}	3.11
Black pepper	23.41^{a}	7.44^{a}	3.14
Protexin (0-200 g.kg)			
(P0)	21.00^{a}	6.04^{b}	3.47^{a}
(P1)	20.10^{b}	6.52^{a}	3.30^{b}
(Herbals × Protexin)			
Control × (P_0)	22.11^{b}	6.47^{bc}	3.41^{a}
Ginger × (P_0)	22.18^{b}	6.74^{bc}	3.29^{a}
Red pepper × (P_0)	21.61^{ab}	7.10^{bc}	3.04^{a}
Black pepper × (P_0)	21.70^{ab}	7.25^{ab}	3.00^{ab}
Control × (P_1)	21.85^{ab}	7.41^{b}	2.95^{ab}
Ginger × (P_1)	22.11^{ab}	8.21^{b}	2.69^{b}
Red pepper × (P_1)	22.20^{a}	8.38^{b}	2.65^{b}
Black pepper × (P_1)	22.31^{a}	8.60^{a}	2.60^{b}

*No protexin and herbals kept as control, and for others 2% ginger (T1), 2% red pepper (T2) and 2% black pepper (T3) without (P_0) or with (P_1) (0-200 g/kg) protexin.**Feed intake (FI), body weight (BW), feed conversion ratio (FCR). ^{a,b,c}Means within row with no common on letter are significantly different ($P<0.05$).

Table 2. The effects of herbals and protexin on some organ's percentage.

Treatments*	Carcass %	Breast %	Drumstick %	Gizzard %	Intestine %
Herbals					
Control	81.29	36.00	24.60	2. 74	3.60
Ginger	82.01	36.16	25.10	2.40	3.49
Red pepper	82.30	37.22	26.00	2.59	3.75
Black pepper	83.16	37.18	26.20	2.71	3.82
Protexin (0- 200 g/kg)					
(P_0)	81.60	36.49	25.11	2.32	3.65
(P_1)	82.44	37.11	26.24	2.50	3.79
(Herbals× Protexin)					
Control × (P_0)	81.80	36.12	25.00	2.24	3.30
Ginger × (P_0)	82.00	36.17	26.01	2.30	3.41
Red pepper × (P_0)	82.21	36.51	27.00	2.41	3.50
Black pepper × (P_0)	82.39	36.67	27.14	2.49	3.62
Control × (P_1)	82.48	36.70	26.64	2.38	4.00
Ginger × (P_1)	82.60	37.01	27.75	2.41	4.01
Red pepper × (P_1)	83.10	37.21	27.68	2.58	4.20
Black pepper × (P_1)	84.11	37.32	28.02	2.61	4.40
P Value	n.s	n.s	n.s	n.s	n.s

*No protexin and herbals kept as control, and for others 2% ginger (T1), 2% red pepper (T2) and 2% black pepper (T3) without (P_0) or with (P_1) (0-200 g/kg) protexin.**Feed intake (FI), body weight (BW), feed conversion ratio (FCR).

stimulant, carminative, digestion and antimicrobial properties.

Rajmane[20] showed a significant improvement in body weight, improved feed conversion efficiency and reduction in mortality with the use of protexin as a growth promoter such as cornflower in broilers. Also, Shabani *et al*.[30] showed that the chicken broilers feed with protexin have the lowest feed conversion ratio and was the most favorable. These results are similar to the findings of Ayasan and Okan,[17] who reported that growth performance parameters and carcass characteristics of Japanese quails was not affected by protexin supplementation. Data from this study showed that carcass percentage had increased but not significantly. This result agree with *Kavyani et al*.[31] who indicated that carcass yield would increase in broilers fed by probiotics (P<0.05).In this study herbals could increase growth performance of quails. Al-Kassie *et al*.[32] demonstrated that black pepper affects the absorption power, decrease material transit velocity and increase digestive enzymes acts and increased chicks dietary and weights gain. These results were in line with the finding of Hosseini,[33] who reported that, black pepper increased ingestion through arousing digestive liquids of stomach and eradication infectious bacteria. Yoshiokawa *et al*.[34] confirms that, the carbohydrate oxidation rate was gradually increased after a meal containing hot pepper and there was significant difference between the hot pepper diet and control diet. In this study using of red and black pepper could improve dressing percentage none significantly. Similar results have obtained by Al-Kassie *et al*.[32] who reported that, the inclusion of mixture of hot red pepper and black pepper at level 0.75 and 1% in the diets improved significantly (P<0.05) the dressing percentage of broilers. In contrast, Safa Mohammad and Wahab[7] mentioned that the inclusion of different mixture powder levels of red and black peppers significantly (P<0.05) reduced the abdominal fat percentage. Drumstick percentage was increase were broilers fed with herbals. Data from this study showed that percentage of gizzard was higher in the herbals groups and it was at the lowest in control group. These observations are correlated with the data published by other researchers.[4,35-37] Data from Table 3 showed that the triglyceride, cholesterol and LDL tended to decrease were quails fed by herbals and protexin. Al-Kassie *et al*.[32] noted that the inclusion of hot red pepper at levels of 0.50%, 0.75% and1%inthebird'sdietsdepressed the cholesterol concentration. Valiollahi *et al*.[5] showed that triglyceride level had decreased none significantly in the ginger and black pepper groups while cholesterol level decreased significantly (P<0.05).They mentioned that decrease in cholesterol levels in broilers may be attributed to the ginger possesses anti hyper-cholesterolemic activity. The de-conjugation of gallbladder acids in small intestine can affects control of serum cholesterol, while de-conjugated acids are not capable to absorb fatty acids as conjugated acids Malini *et al*.[36]

Sarica *et al*.[10] showed that use of essential oils in combination with the enzyme complex, a probiotic and an oligosaccharide with or without the enzyme complex in the wheat-based diet significantly reduced the intestinal viscosity compared to the control diet, these treatments negatively decreased plasma total cholesterol and triglyceride on quails. De-conjugation of gallbladder acids in small intestine can affects control of serum cholesterol, while de-conjugated acids are not capable to solve and absorb fatty acids as conjugated acids. As a consequence, they prevent from absorption of cholesterol.[11,24]

Table 3. The effects of herbals and protexin on some blood biochemical.

Treatments*	Glucose (mg/dL)	Cholesterol (mg/dL)	Triglyceride (mg/dL)	HDL (mg/dL)	LDL (mg/dL)
Herbals					
Control	169.22	212.01^{a}	208.03^{a}	100.21^{d}	146.54^{a}
Ginger	170.45	208.41^{b}	207.21^{b}	102.30^{c}	134.23^{b}
Red pepper	172.34	206.30^{b}	202.23^{c}	102.15^{b}	122.54^{c}
Black pepper	174.45	200.37^{c}	198.22^{d}	106.08^{a}	100.11^{d}
Protexin (0-200 g.kg)					
(P_0)	170.17	200.42^{b}	200.00^{b}	100.10^{a}	125.34^{a}
(P_1)	172.36	202.406^{a}	203^{a}	105.34^{a}	126.28^{a}
(Herbals× Protexin)					
Control × (P_0)	170.10	209.13^{a}	208.30^{a}	100.88^{c}	134.93^{a}
Ginger × (P_0)	171.25	207.01^{a}	204.20^{b}	101.16^{cb}	132.16^{a}
Red pepper × (P_0)	169.45	207.52^{a}	202.14^{dc}	102.47^{bc}	127.51^{ab}
Black pepper × (P_0)	168.54	204.36^{ab}	200.36^{d}	100.13^{cb}	116.23^{b}
Control× (P_1)	170.00	206.34^{a}	205.41^{a}	105.20^{ab}	123.07^{ab}
Ginger × (P_1)	169.31	207.45^{a}	203.25^{a}	101.60^{ab}	118.19^{b}
Red pepper × (P_1)	170.25	202.43^{b}	201.20^{ab}	106.46^{ba}	113.24^{b}
Black pepper × (P_1)	171.63	206.55^{b}	199.70^{c}	110.06^{a}	108.77^{c}
P Value	ns	**	**	**	**

*No protexin and herbals kept as control, and for others 2% ginger (T1), 2% red pepper (T2) and 2% black pepper (T3) without (P_0) or with (P_1) (0-200 g/kg) protexin.**Feed intake (FI), body weight (BW), feed conversion ratio (FCR). ^{a,b,c}Means within row with no common on letter are significantly different (P<0.05).

Conclusions

In conclusion, the supplementation of ginger, red pepper and black pepper powder with protexin probiotic at level 2% enhanced growth, productive performance and some blood biochemical parameters of Japanese quails. Also, we could be explained that this improvement on growth and health may be due to the biological functions of them, due to the roles as stimulant, enhanced digestibility, anti-oxidant, anti-helmitic, anti-microbial and other activities or the prevention of gastric toxicity. Additionally, further tests are needed to explore and more detail explanation.

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