Effect of purslane powder on the performance and immunity system of broiler chickens

Abstract

Due to its high nutritional value and antioxidant and antimicrobial properties , purslane was selected as the target plant for the present study to investigate the effect of adding purslane powder on the flock performance, and immune response against Newcastle and infectious bursal disease. purslane seeds was purchased from medicinal company from India and after preparation was used as 1% powder. In order to investigate the effect of purslane powder on the performance and immunity system of broiler chickens, an experiment was conducted using 180 one-day-old Ross 308 broiler chickens. This experiment was carried out in a completely randomized design with three treatments, four replicates and 15 birds each. The experimental treatments were negative control (basic feed without using purslane powder and without vaccination), positive control (basic feed without adding purslane powder but vaccinated against Newcastle and infectious bursal disease virus(IBDV), and purslane group (basic feed with 1% purslane powder and vaccination) .The results of the experiment showed that performance indicators such as total weight at the end of the period, body weight gain, and European Production Efficiency Factor decreased with vaccination and increased significantly with the use of purslane powder in vaccinated chickens ($p < 0.05$). Antibody titer against Newcastle disease virus in vaccinated chicks received purslane powder was more than vaccinated group without purslane but the difference was not significant ($p>0.05$). Antibody titer against IBD vaccine increased in both vaccinated groups but in the purslane group antibody titer was significantly more than group, only vaccinated ($p < 0.05$). It was concluded that supplementing broiler feed with purslane, can improve broiler flock performance, enhance the immune response against ND and IBD vaccination, and positively affect on intestine microflora population.

Key Words: Immunity system, infectious bursal disease virus, Purslane, Newcastle disease, Vaccine.

Introduction

In most countries of the world, the poultry industry has contributed greatly to the food security of the people in terms of providing cheap protein. Along with the progress in this industry, the demand for healthy and antibiotic-free products has also increased, leading to the establishment of laws prohibiting the use of antibiotics in some countries. Banning the use of antibiotics along with the occurrence of bacterial and viral diseases has caused a lot of damage to poultry farms and researchers are looking to solve this challenge. The use of proper breeding programs, the production of effective vaccines, the use of appropriate compounds such as medicinal plants, probiotics, prebiotics, acidifiers, etc. are part of these efforts. Diseases such as Newcastle disease and infectious bursal diseases are considered to be some of the most important threats to poultry farms by affecting health and reducing birds' efficiency, and they cause a lot of economic damage to the poultry industry every year (1,2).

Infectious bursal disease (IBD) is an acute viral disease that causes a lot of damage and high mortality. (1,3). The acute form of the disease occurs in chickens between 3-5 weeks old and is associated with symptoms such as diarrhea, immobility, loss of appetite, tremors, loss of balance and death. Immunodeficiency caused by IBD in chickens makes the flock susceptible to other viral, bacterial, and parasitic infections and thus leads to indirect losses. (1,3).

Purslane (***portulaca Oleracea*****) is** a plant that exists everywhere and is used as an edible vegetable or medicinal plant in Iran and in some countries. This plant most used medicinal plant recorded in the World Health Organization (4). Purslane is the richest vegetable sources of omega-3 fatty acids (Simopoulos and Salem, 1986). In complete purslane review, the plant is a rich source of various important phytochemicals such as flavonoids, alkaloids, terpenoids, proteins, carbohydrates, and vitamins such as A, C, E, and B, carotenoids and minerals such as phosphorus, calcium, magnesium and zinc. It is particularly very important because of the presence of a very high concentration of

omega-3- fatty acids especially α-linolenic acid, gamma-linolenic acid and linoleic acid, which are not generally synthesized in terrestrial plants. Various parts of purslane are known for ethnomedicinal and pharmacological uses because of its anti-inflammatory, antidiabetic, skeletal muscle relaxant, antitumor, hepatoprotective, anticancer, antioxidant, anti-insomnia, analgesic, gastroprotective, neuroprotective, wound healing and antiseptic activities. Due to multiple benefits of purslane, it has become an important wonder crop and various scientists across the globe have shown much interest in it as a healthy food for the future. Due to multiple benefits of purslane, it has become an important wonder crop and various scientists across the globe have shown much interest in it as a healthy food for the future (9). The study showed that addition 0.2% Purslane extract to broiler feed improved flock performance, and increased *lactobacterium* sp, and decreased *Escherchia coli* population in the gastrointestinal tract (5). Purslane had the positive effect on cecal microflora (6). The effects of dietary supplementation of purslane powder (PP) on performance, blood indices, and antioxidant status in broilers with triiodothyronine (T3)-induced ascites Evaluated, and concluded the supplementation of purslane in the feed improves oxidative status and reduces ascites incidence without impairing growth performance in broiler (7).Reported intake of 2 % and 3 % purslane could significantly increase the body weight gain and lead to a reduction in FCR. Moreover, purslane feeding increased the relative abundance of beneficial bacteria in the chicken intestines(8). Therefore, due to its high nutritional value and antioxidant and antimicrobial properties , purslane was selected as the target plant for the present study in order to investigate the effect of adding purslane powder on the flock performance, and immune response against Newcastle and infectious bursal disease.

Material and Methods

Preparation of purslane seed

purslane seeds was purchased from Shree Herbals, Shree AyurShree company from India, and after preparation was used as 1% powder in G3.

Experiment Design

The experiment was conducted with 180 broiler chickens, Rass 308 with uniform weight and randomly allocated to 3 groups, 4 replications and 15 chickens per replication for 35 days.

The control group was fed only basal diet, group 2 was fed basal diet and vaccinated, and group 3 was fed basal diet containing 1% purslane powder and vaccinated(Table 1). European Production Efficiency Factor were calculated according to following formula (10)

Table 1- Vaccination program

Treatments	Vaccine ND	Vaccine IBD	Basic feed	purslane 1%
G1	-	-	+	-
G2	1st day spray and repeated at 10 and 28 days *via* drinking water (DW)	14 + 24 days *via* (DW)	+	-
G3	1st spray and repeated at 10 and 28 days *via*	14+ 24 *via* (DW)	+	+

DW

1-Newcastle vaccine in one day as a spray and in 10 and 28 days in drinking water, **ND + IB (**Boehringer Ingelheim.- Germany)
2- Infectious bursal disease vaccine at 14 and 24 days orally, (Boehringer Ingelheim- Germany)

In order to check the immune response of broiler chickens, on 17th and 35th days of rearing, 5 birds were randomly selected from each replication and blood was collected from wing vein of each bird. Then each blood sera transferred into microtube and kept in refrigerator until ELISA test was performed.

On the 35th day of the experiment, 5 chickens from each group were randomly selected and after weighing were euthanized, the relative weight of spleen and bursa was measured and whole cecum of broiler chickens from different experimental groups were collected under high health conditions and sent to the laboratory. Serial dilutions were prepared and cultured in nutrient agar medium and kept at 37°C for 24 hours. Then the plates with the number of 25 to 250 colonies were counted.

Statistical analysis:

Statistical analysis of the data was performed using SAS (Statistical Analysis System – Version 9.1). To assess significant differences between means, two-way ANOVA and least significant difference (LSD) post hoc test were performed. Chi-square was used to evaluate significant differences between proportions. $P<0.05$ is considered statistically significant(SAS\SAT 2010).

Results

The effect of adding purslane in the feed of broiler chickens vaccinated against Newcastle and Gambro diseases on flock performance and immune response are shown in Table 2. Birds weight, body weight gain, feed consumption, and European efficiency factor decreased under influence of vaccination but feed conversion ratio increased ($p<0.05$). Addition of

purslane powder in the feed of vaccinated chickens, increased the weight birds, body weight and European efficiency factor and decreased feed conversion ratio ($p<0.05$) but feed consumption was not affected. The highest consumption of feed was observed in the control group.

The results of the effect of adding purslane in the feed of broiler chickens on the antibody titer against Newcastle and Gumboro at 17 and 35 days of age are shown in Tables 3 and 4. The antibody titer on 17th and 35th days after vaccination, against Newcastle and Gumboro at 17 and 35 days of age was increased but only for Gumboro was significant ($p < 0.01$).

The results in table3 show that vaccination did not have much effect on the relative weight of liver and spleen except in group with purslane ($p<0.05$), but in the purslane group, the relative weight was significantly higher than vaccinated group $p > 0.05$). The relative weight of bursa was affected by vaccination and increased with vaccination ($p<0.05$), but no significant difference was observed with the addition of purslane powder.

The results of the effect of adding purslane in feed of broiler chickens vaccinated against Newcastle and Gambro on the population of cecum bacteria are shown in Table 5. The results show that the population of cecum bacteria decreases with vaccination, but the population of cecum bacteria increases significantly with the addition of purslane powder.

Discussion

The design of the experiment was to evaluate the use of medicinal plants in order to strengthen the immune system and reduce the effects of vaccination stress. Medicinal plant compounds may affect the immune system in two ways, directly (by stimulating the lymphatic tissues) and indirectly (by changing the microbial population of the digestive system). The results showed that the relative weight of the bursa increased with vaccination, but no significant difference was observed with the addition of purslane powder. The relative weight of the spleen was not affected by vaccination, but it increased significantly with the addition of purslane powder.

The body weight gain and The European performance indicators of broiler during the vaccination challenge in group 2, decreased and in group 3 due to the positive effect of purslane powder increased by 71% and 86% respectively. Researchers believe that the use of purslane in the feed by affecting the central and peripheral nervous system through interference with opioid receptors increases the appetite and increases the overweight of broiler chickens (11). Some researchers mentioned by increasing purslane up to 5% in broilers', feed consumption and weight gain increased significantly and can improve broiler chicken antioxidant status (12,13, 14). In present research we find positive effect of addition purslane powder 1%, on feed consumption, body weight gain and FCR, which was in agreement with some researcher. They mentioned, reason for the increase in feed consumption to be the improvement of palatability of the feed by adding purslane, and increase feed consumption resulted in the improvement of weight gain(15). In one study

Portulaca oleracea (purslane) extract (POE) supplementation improved quails' performance and nutritive values for some substances (CF, DM, OM, NFE, TDN, andME). Moreover, POE did not cause any harmful effects on birds' liver and kidney functions. In addition, this extract promotes immunity and antioxidant status and minimizes the harmful microbial load in the quails' intestines, so they recommend using POE as feed additive. These researchers believed that the increase in body weight is due to the improvement of digestibility and absorption of nutrients due to the presence of purslane extract (16,17).

An increase in the antibody titer indicates the stimulation of the host's immune system, and vaccination is the best method to prevent damage caused by infectious diseases in humans and animals and creates a strong immune response to provide long-term protection against infection.

We find increased antibody titer against Newcastle diseases antibody in the chicken receiving purslane powder was higher than the vaccinated group without purslane powder in diet and had positive effect on antibody production.

In this regard, the researchers showed that the concentration of IgM and IgA increased compared to the control group when using purslane in quail feeding, which they believe is due to premature maturation of humoral immune responses (16). In agreement with the results of the present study regarding the Newcastle vaccine. Some researcher found positive effect of bioherbal supplements in feeding broilers on the level of Newcastle-specific antibody. In another study, the simultaneous use of Eucalyptus and mint plant essential oils at a dose of 250 ml per 1000 liters of drinking water was beneficial on the titer of Newcastle and influenza in broiler chickens (2) .The researchers showed different levels of purslane extract (11) In a study, it has been determined that adding vitamin E and L-carnitine alone and in combination with purslane in a low-protein diet can improve the immune system and

health of broiler chickens under cold stress by creating synergistic effects (14) and It can also act as an immune modulator and antioxidant agent (4).

We found adding purslane 1% in diet improve bursa of Fabricius weight, spleen and intestinal microbial population of birds. The results of the effect of adding purslane in the diet of broiler chickens vaccinated against Newcastle and infectious bursal disease on the population of cecum bacteria, show that with vaccination, the population of cecum bacteria decreased, while adding purslane powder the population of cecum bacteria increased significantly.In a study by Ghorbani et. al., 2014, concluded broiler immunity was not affected by inclusion of purslane extract in the feed but a positive effect on cecal microflora composition(11). It was reported, when using purslane powder compared to the control group, the population of E. coli significantly decreased and the population of Lactobacillus bacteria increased significantly (12). The use of purslane extract can increased the population of lactobacillus and bifidobacter in the cecum contents of broiler chickens (5). Researchers believe that the reason for the increase in the population of lactobacilli when using purslane powder can be found in the content of phenolic compounds in purslane, because lactobacilli are able to metabolize phenolic compounds to provide energy for cell metabolism. In agreement with present study, reported adding purslane to feed increased the abundance of beneficial bacteria such as lactobacillus in the intestine and reduce harmful bacteria such as Enterobacteriaceae (Escherichia-Shigella) (5).

It was concluded supplementing broilers feed with purslane, can improve broiler flock performance, enhance immune response against viral diseases and had positive effect on intestine microflora population.

Table 2: The effects of purslane on the performance of broiler chickens at 35 days old

Groups	Total Weight(g)	Weight gain(g)	Feed consumption(g)	FCR	EPEF
G1	1092.5 b	1052.3 b	2855 a	2.71b	115.1b
G2	955.1c	915.1c	2655.3 b	2.90a	94.1c
G3	1608.3a	1568.3a	2613.7b	1.67c	275.7a
SEM					24.47
P-value	84.80	84.81	34.66	0.16	
	0.0001	0.0001	0.0003	0.0001	0.0001

* Different letters in each column indicate significant differences (P<0.05).

Table3: The effect of purslane powder in broiler chickens against Newcastle diseases

Group		
	17 days(Newcasle Dis. Titer)	**35 days**
G1	**1** [b]	**1.02** [b]
G2	**3011.8** [a]	**3032. 1** [a]
G3	**3016 .7** [a]	**3112 .8**[a]
SEM	**284.3**	**270.1**
P-value	**0.0001**	**0.0001**
LSD	261	

*Mean values of logarithmic count for different products with different superscript letters in the same rows are significantly different at (P<0.05).

Table4: The effect of purslane powder in chickens against infectious bursal diseases vaccination by ELISA method.

Group	Age	
	17 days	35 days
G1	0.11 [c]	0.21[c]
G2	2050. 8 [b]	3284.1[b]
G3	3041.4[a]	3402.5[a]
SEM	236.2	293.5
P-value	0.0001	0.0001

* Different superscript letters in the same rows are significantly different at (P<0.05).

Table5: The effect of purslane powder on the relative weight of spleen, bursa of faricus (%) and the microbial population of the cecum (log cfu/g) of broiler chicks at 35 days of age.

Type equation here.

Group	Burs of Fabricus	Spleen population	Intestine microbial
G1	1.68[b]	.0.03[b]	2.68[b]
G2	2.39[a]	0.05[b]	2.39[c]
G3	3.03[a]	.12[a]	3.03[a]
SEM	0.17	0.01	0.17
P-value	0.0001	0.0001	0.0001

* Different superscript letters in the same rows are significantly different at (P<0.05).
SEM: standard error of the mean.

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Declaration of Conflict of Interest

The authors declare that there is no conflict of interest.

Ethics

This study follows the ethics guidelines of the Faculty of *Veterinary* Medicine, Shahid Chamran University of Ahvaz; Ahvaz, Iran (EE/1401.2.25.36771/Scu.ac.ir).

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