Effect of Dietary Supplementation of *Artemisia Siberia* Powder and Extract on Intestinal Morphology in Broiler Chicks

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ABSTRACT

The present trial was conducted to investigate the effect of different levels of *Artemisia Siberia* powder and ethanol extract on intestinal morphology in broiler chicks. A total of 480 day-old mixed sex broiler chicks (Ross 308) were randomly allotted to 8 dietary treatments with 5 replicates of 12 birds in a completely randomized design. Dietary treatments consisted of a control diet, antibiotic diet (0.02% virginiamycin), diets contain in 0.05, 0.10 and 0.20% *Artemisia Siberia* extract and diets contain in 0.50, 1.00 and 2.00% *Artemisia Siberia* powder, which fed during a 35 day trial period. At day 29 of age two birds per replicate were slaughtered to evaluate morphological alterations in jejunal epithelial cells. The results showed that, utilization of different levels of *Artemisia Siberia* powder and/ or extract increased jejunal villi height, while the smallest villi was assigned to the birds fed on control diet ($P<0.05$). From the present results, it seems that dietary utilization of *Artemisia Siberia* specially *Artemisia Siberia* extract in addition to elimination of antibiotics medications, could increase jejunal villi height in broiler chicks.
Key words: Broiler chick, *Artemisia Siberia*, Antibiotic, Intestinal morphology

1. INTRODUCTION

The genus *Artemisia* (*Asteraceae*) is the largest and most widely distributed one of the approximately 60 genera belonging to the tribe anthemideae. This genus comprises a variable number of species, ranging from 200 to over 400, which are predominantly distributed in the northern temperate region of the world in the 0-50 cm precipitation area. Thirty- four genera of them are reported in Iran and some are endemic (Ghorbani et al, 2008). *Artemisia Siberia* is a well-known medicinal plant that has been used in the Middle East traditional medicine for

treating various diseases. It is used as an anthelminthic by the local population. The plant is also used as antimicrobial, poison antidote and emmenagogue (Kamal et al, 2007). *Artemisia* contains secondary compounds, such as phenolic compounds, potentially psychoactive terpenes (e.g., thujone which is toxic at high doses) and sesquiterpene lactones (i.e., absinthin and anabsinthin) which are responsible for the well-known bitter taste of *Artemisia* (Kim et al, 2006). *Artemisia* extracts have been used to aid digestion, exterminate parasites, as well as cure gastro-enteric disorders, constipation and neuralgia in traditional medicine and phytotherapy (Kim et al, 2006). Both villous height and crypt dept are important indicators of broilers digestive health and directly related to the absorptive capacity of mucous membrane (Buddle & Bolton, 1992). From a theoretical point of view, villous height reflects a balance between the mitotic activity of the crypt enteric cells (Cera et al, 1988) and the desquamation produced principally by external aggressors (Nabuurs, 1995). The villous:crypt ratio is an indicator of the likely digestive capacity of the small intestine. An increase in this ratio corresponds to an increase in digestion and absorption (Montagne et al, 2003). Although the antimicrobial and antioxidant properties of plant oils are well known and confirmed in numerous studies (Manzanilla et al, 2004), there is only slight evidence on morphological and histological investigations referring to active plants oils action in animals fed on diets supplemented with plant extracts. Also, the influence of feeding *Artemisia* Siberia powder and extract on the intestinal morphology of chickens is also unknown. Since in-feed antibiotics (IFAs) are being taken out of broiler diets around the world, beginning in Sweden in the year 1986, the search for alternatives to replace IFAs has gained increasing interest in animal nutrition. Gut microflora appears to be the target for IFAs and alternatives to exert health benefits and some growth-promoting effects (Yang et al, 2009). This study examined the effect of substituting antibiotic with different levels of *Artemisia* Siberia powder and extract on intestinal morphology in broiler.

2. MATERIALS AND METHODS

Artemisia Siberia

Artemisia Siberia plant was obtained from Pakan Bazr Company, Isfahan, Iran, in February 2011. Then powder was provided after milling and plant extract was measured by HPLC (Hernandez et al, 2004). It was analyzed for its essential oils content.

Bird and Experimental Diets

This study was carried out in experimental farm of Islamic Azad University – Khorasgan Branch, Isfahan, Iran. The day-old mixed sex broiler chicks (Ross 308)

were purchased from a commercial hatchery. The chicks were housed in floor pens (1.2 × 1.2 m) containing pine shavings throughout the trial. A total of 480 chicks were randomly allocated to 40 pens of 12 birds in a completely randomized design and fed experimental diet from 7 to 42 d of age. The chicks were assigned to pens so that initial BW and weight distributions were similar among different dietary treatments. Five replicate pens were assigned to each of the 8 experimental diets. The commercial basal diets were formulated to meet the nutritional requirement Ross 308 of broiler chicks in different phases of growth. Dietary treatments consisted of a control diet, antibiotic diet (0.02% virginiamycin), diets contain in 0.05, 0.10 and 0.20% *Artemisia* extract and diets contain in 0.50, 1.00 and 2.00% *Artemisia* powder, which fed during a 35 day trial period. The composition of experimental diets is given in table 1.

Table 1: Ingredient composition (as percent of dry matter) and calculated analysis of the basal diets[1]

Ingredients	Starter	Grower	Finisher
Corn	53.41	57.84	61.72
Soybean meal	40.20	36.50	32.23
Soybean oil	2.00	1.94	2.12
Mono Calcium Phosphate	1.35	1.20	1.28
Calcium Carbonate	1.70	1.43	1.65
Common salt	0.35	0.34	0.34
DL- Methionine	0.31	0.22	0.17
Lys-HCl	0.12	0.04	0.00
Vit & Min premix[2]	0.50	0.50	0.50
Calculated analysis			
ME[3], kcal/kg	2900	2950	2997
CP[4], %	21.73	20.60	18.83
Ca, %	0.97	0.84	0.92
AP[5], %	0.46	0.42	0.43
Met + Cys, %	0.72	0.42	0.80
Lys, %	2.10	1.16	1.03

[1] Basal diet supplemented with different type and amounts of additives (*Artemisia* powder (0.5, 1 and 2%) and extract (0.05, 0.10 and 0.20%) and antibiotic) for other treatments; [2] vitamin and mineral provided per kilogram of diet: vitamin A, 360000 IU; vitamin D3, 800000 IU; vitamin E, 7200 IU; vitamin K3, 800 mg; vitamin B1, 720 mg; vitamin B9, 400 mg; vitamin H2, 40 mg; vitamin B2, 2640 mg, vitamin B3, 4000 mg; vitamin B5, 12000 mg; vitamin B6, 1200 mg; vitamin B12, 6 mg; Choline chloride, 200000 mg, Manganese, 40000 mg, Iron, 20000 mg; Zinc, 40000 mg, copper, 4000mg; Iodine, 400 mg; Selenium, 80 mg; [3]metabolizable energy; [4]crude protein; [5]Available phosphorous.

Feed and water were provided for ad libitum consumption and chicks had access to 24 h lighting schedule during the experiment. Temperature was 32°C during the first week of age and was reduced by 2°C/week until the birds were 5 weeks old.

Recording and Chemical Analysis

At 29 day of age two birds per replicate were slaughtered to evaluate morphological alterations in jejunal epithelial cells. Jejunum fragments of ten-centimeter length were collected from ten individuals of each treatment that were preserved in Formalin solution for morphometric evaluation. Tissue samples for histological study were sectioned at 3 μm, and stained with haematoxylin and eosin (Manzallia et al, 2004).

Statistical Analysis

Data were subjected to analysis of variance in a completely randomized design using the General Linear Models (GLM) procedure of SAS® (SAS Institute, 2004), and when treatment means were significant ($P<0.05$), Duncan's multiple range test (Duncan, 1955) was used. Single degree of freedom contrasts were made among treatment means to compare negative versus positive control group, positive control versus *Artemisia*-fed groups, and also negative control versus *Artemisia*-fed groups.

3. RESULTS AND DISSCUSION

The effects of treatments on intestinal morphology of broiler chickens at days 29 of age are shown in Table 2.

Results of this study indicated that at day 29 of age, There were significant ($P<0.05$) difference between experimental groups in the light of villus height. Dietary supplementation of *Artemisia* extract and powder resulted in significant ($P<0.05$) increases in villus height were compared to control. While, the highest villus height: crypt depth ratio, was allotted to the birds fed on 0.05% *Artemisia* extract, but there was not significant ($P>0.05$) difference between experimental groups. These results are in line with those of some researchers (Darabi Ghane et al, 2010).

The present observations show that increases in villus height may be due to the antioxidant and antimicrobial properties of *Artemisia Siberia* powder and extract that caused loss of harmful microflora and increase health jejunum.

Table 2: Effect of different levels of *Artemisia* powder and extract in comparison with virginiamycin antibiotic on intestinal morphology broiler chicks at 29 day of age

Treatments	Villus height (µm)	Crypt depth (µm)	VCR[1]
Control	966.80[c]	196.40	4.99
Antibiotic	1214.80[a]	184.80	6.61
ASE[2], 0.05%	1163.40[ab]	176.40	6.70
ASE, 0.10%	1146.60[ab]	184.00	6.36
ASE, 0.20%	1057.00[bc]	216.60	4.94
ASP[3], 0.50%	1075.00[abc]	190.60	5.84
ASP, 1.00%	1171.40[ab]	188.20	6.31
ASP, 2.00%	1124.20[ab]	194.20	5.85
		***P*-value**	
Treatments [4]	0.0103	0.3479	0.0693
Contrasts			
Control vs. Antibiotic	0.0027	0.4511	0.0044
Control vs. *Artemisia*	0.0023	0.7071	0.0776
Antibiotic vs. *Artemisia*	0.0705	0.5873	0.2712
SEM	43.80	11.07	0.47

[1]VCR = villus height: crypt depth ratio
[2]ASP = *Artemisia Siberia* powder; [3]ASE = *Artemisia Siberia* extract.
[4]*P*-value was calculated for studied treatments on broiler birds.
[a–c] within each column Means with no common superscript are significantly ($P < 0.05$) different.

4. CONCLUSIONS

The results showed that, dietary supplementation of *Artemisia* powder and extract resulted in significant increases in villus height (P<0.05). From the present results, it seems that dietary utilization of *Artemisia* especially *Artemisia* extract in addition to elimination of antibiotics medications, could improve villus height in broiler chicks.

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