www.roavs.com EISSN: 2223-0343
RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

The effect of virginiamycin and black pepper (*Piper nigrum L.*) extract on performance of broiler chicks

Hossein Ghaedi*[1], Javad Nasr [2], Frashid Kheiri[1], Yaser Rahimian[1] and Yasamin Miri[3]

[1]Department of Animal Science, Islamic Azad University, Shahrekord branch, Shahrekord, Iran; [2]Department of Animal Science, Islamic Azad University, Saveh branch, Saveh, Iran; [3]Agricultural Jahad Institutes of Technical and Vocational Higher Education, Isfahan Education Centre, Isfahan, ran

Abstract

An investigation was carried out to determine the effect of virginiamycin and black pepper extract on performance of broiler chicks. A total of 240 day old (Ross 308) broiler chicks were divided into three groups. Treatment diets were basal diet (T1), basal diet with 200 g/ton virginiamycin powder (T2) and basal diet with 2 mg/ml black pepper aqueous extract (T3). Data was collected on feed intake, body weight gains and feed conversion ratio. Blood samples were analyzed for triglyceride, HDL, LDL and antibody titre against Newcastle disease vaccine. In addition, intestinal microbial populations for *Escherichia coli* and *Lactobacillus* (Cfu/g) were also investigated. The results showed that carcass characteristics improved significantly ($P<0.05$) in T2 and T3. Serum cholesterol profile and antibody titre improved in experimental diets ($P<0.05$) compared to the control. The intestinal population of *E. coli* decreased and *Lactobacillus* increased significantly in treated groups. In conclusion, the aqueous extract of black pepper produced better results compared to control and virginiamycin treatment.

Keywords: Antibiotics; broilers; performance; growth promoters; phytogenic additives

To cite this article: Ghaedi H, J Nasr, F Kheiri, Y Rahimian and Y Miri, 2014. The effect of virginiamycin and black pepper (*Piper nigrum L.*) extract on performance of broiler chicks. Res. Opin. Anim. Vet. Sci., 4(2), 91-95.

Introduction

The use of antimicrobial feed additives such as antibiotics and drugs as growth promoters were banned in poultry diets in 2006 by the European Union (Castanon, 2007). Herbal extracts, spices and phytogenic additives have been used as alternatives to antibiotics as growth promoters in broiler diets. The effect of a phytogenic feed additive on nutrient digestibility has been well illustrated in many studies (Demir, et al., 2003; Moorthy et al., 2009). Phytogenic feed additives are plant derived products used in poultry feeding to improve the consumption and digestibility of feed and weight gain in broiler chickens (Al-Harthi, 2002; Ficker et al., 2003; Windisch et al., 2008; Moorthy et al., 2009; Rahimi et al., 2009). *Piper nigrum* has been found to have antioxidant properties and anticarcinogenic effect, especially when compared to chili (Nalini et al., 2006).

Piper Nigrum has medicinal uses and has been common medicines for various disorders of humans in traditional Indian families (Moorthy et al., 2009). It prevents the induced oxidative stress, inhibit lipid per oxidation and arrests different radicals such as hydroxyl and super oxides radicals (Weiner, 1994). Pepper contains cupsaeesin, cupsisin and cupsantine and some of them allay rheumatic aches. Piperine (1-piperoyl-piperidine) is a major alkaloid component of black pepper which has antiache effect (Moorthy et al., 2009). In addition, the bioactive molecule, piperine is present in pepper has major pharmacological impacts on the nervous and neuromuscular systems and it can help in digestion (Ferreira et al.., 1999; Great head, 2003). Some studies showed that treatment with virginiamycin at suggested dosages has a beneficial effect on body weight gain and feed conversion efficiency in poultry (Dumonceaux et al., 2006; Rahimi et al., 2009).

Corresponding author: Hossein Ghaedi, Department of Agriculture, Faculty of Animal Science, Islamic Azad University, Shahrekord Branch, Shahrekord, Iran .Po Box: 166.Tel:+ 98-3813-336100

The objective of this study was therefore to explore the potential of black pepper extract as feed additives and growth promoters in broiler chicks.

Materials and Methods

This study was conducted at Veterinary Poly Clinic, Islamic Azad University, Shahrekord, Iran. A total of 240 one day old (Ross 308) chicks were equally divided into three groups in a completely randomized design. Duration of the experiment was 42 days. The experimental diet was made with corn, soybean meal and wheat grain to provide favourable ME and CP as recommended by NRC (2001). The composition of feed is given in Table 1. The temperature was set at 36°C at first and eventually dropped to 18°C. Chickens were vaccinated by routine vaccination program. During this experiment, feed and fresh water were providing *ad libitum*. Chicks were fed basal diet as control (T1), basal diet with virginiamycin powder 200 g/ton (T2), basal diet with black pepper extract 2mg/ml (T3). Feed offered and refusal was measure daily. The efficacy of the phytogenic was tested. At the end of trial, four birds from each treatment were slaughtered. The blood samples from each bird were collected and stored at refrigerator at 4°C until subjected to biochemical analysis. Cholesterol, triglycerides, high density lipoprotein (HDL) and low density lipoprotein (LDL) were measured as described by Ellefson and Graway (1967) and Zlatkis et al. (1993). Antibody titre against Newcastle vaccine was measured by Haemagglutination inhibition test. Illeocecal intestinal microbial population of *E. coli* and *Lactobacillus* were investigated as described by Dumonceaux et al. (2006).

Statistical analysis

The collected data were analyzed by using the General Linear Model (SAS, 2001). Means were compared by Duncan's multiple ranges test. P value less than 0.05 was considered as significant.

Results

Result of feed intake per day, body weight gain per day, feed conversion ratio, total feed intake and total body weight are given in Table 2. As evident from the results, it is clear that these parameters are significantly high (P<0.05) in treated groups compared to the control. Also it is clear that the performance parameters also increased in T2 compared to control (T1) and T3.

The effect of experimental diets on the percentage weight of carcass characteristics and visceral organs are given in Table 3. Liver and gizzard weight increased significantly in T2 while abdominal percentage decreased in T3. Drum stick and carcass yield percentage increased significantly in experimental treatments compared to control. No significant change was observed in breast meat.

Table 1: Composition of the experimental diets for experimental chicks

Ingredients %	0-02 (weeks)	02-04 (weeks)	04-06 (weeks)
Corn grain	51.64	56.61	60.37
Soybean meal	37.74	32.30	27.81
Wheat grain	5.00	5.00	5.00
Vegetable Oil	1.40	2.03	2.84
DCP	1.56	1.47	1.39
Oyster shells	1.17	1.13	1.08
Methionine D-L	0.30	0.29	0.27
Lysine-L	0.13	0.13	0.30
Nacl	0.26	0.24	0.14
Vitamin Premix*	0.30	0.30	0.30
Mineral Premix*	0.30	0.30	0.30
Virginiamycin	0.20	0.20	0.20
Calculated nutrient content			
ME (Kcal/Kg)	2.850	2.950	3.050
CP %	22	20	18.5
Ca %	0.90	0.85	0.80
Available Phosphorus %	0.45	0.42	0.40
Lysine %	1.35	1.20	1.16
Na %	0.16	0.15	0.15
Methionine + Cystine %	0.97	0.87	0.85

*Supplied Per Kilogram Of Feed: 7.500 IU of vitamin A, 2000IU vitamin D3, 30 mg vitamin E, 1.5 µg vitamin B12, 2 mg B 6, 5 mg vitamin K, 5 mg vitamin B2, 1 mg vitamin B1, 40 mg nicotinic acide, 160 µg vitamin biothine, 12 mg calcium pantothenate, 1 mg folic acid, 20 mg Fe, 71 mg Mn, 100µg Se, 37 mg Zn, 6 mg Cu, I,400 µg Cu

Table 2: The effect of experimental diets on broilers performance

Treatments	FI (g/d)	BWG (g/d)	FCR	TFI (g)	Pre-slaughter weigh (gm)
T1	87.17^{c}	40.58^{b}	2.14^{a}	3661.1^{c}	1704.3^{b}
T2	89.22^{a}	43.06^{a}	2.06^{b}	3747.2^{b}	1808.5^{a}
T3	88.16^{b}	41.27^{a}	2.08^{b}	3702.7^{a}	1733.3^{a}
MSE	0.051	0.072	0.115	0.241	0.312

Means within a column with no common letter are significantly different (P<0.05); T1: Treatment diets were basal diet; T2: basal diet with 200 g/ton virginiamycin powder; T3: basal diet with 2 mg/ml black pepper aqueous extract; FI: feed intake, BWG: body weight gain; FCR: Feed conversion ratio, TFI: total feed intake

The lipid profile of control and treated groups is given in Table 4. Triglyceride and cholesterol concentration decreased in T3 while HDL increased in the same group. LDL concentration decreased significantly in T2. The antibody titre and intestinal microbial population in control and treated groups is given in Table 5. Antibody titre increased significantly in T3 while *E. coli* population decreased in T2. Lactobacillus population increased significantly in T2 and T3 groups.

Discussion

Previous reports indicate that black pepper increases digestibility in broilers (Ghazalah et al.., 2007; Galib et al.,

Table 3: The effect of experimental diets on percentage of some visceral organs

Treatments	Liver (%)	Abdominal Fat (%)	Drumstick (%)	Breast Meat (%)	Gizzard (%)	Bursa of fabrcia (%)	Carcass yield (%)
T1	3.25[b]	4.45[a]	21.25[b]	25.37[a]	3.41[b]	0.252[a]	68.65[b]
T2	3.06[c]	4.01[b]	23.12[a]	26.37[a]	3.75[a]	0.147[b]	72.17[a]
T3	3.48[a]	3.65[c]	22.07[a]	26.08[a]	3.35[b]	0.135[b]	70.20[a]
SE	0.110	0.218	0.145	0.312	0.259	0.141	0.820

Means within a column with no common letter are significantly different (P<0.05); T1: Treatment diets were basal diet; T2: basal diet with 200 g/ton virginiamycin powder T3: basal diet with 2 mg/ml black pepper aqueous extract

Table 4: The effect of added experimental diets on lipid profile of control and treated groups

Treatments	Triglyceride (mg/dl)	Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
T1	69.80[a]	131.21[a]	58.77[c]	69.98[a]
T2	65.18[b]	127.11[b]	62.41[b]	67.16[c]
T3	67.24[c]	125.26[c]	65.62[a]	68.24[b]
MSE	0.221	0.356	0.715	0.117

Means within a column with no common letter are significantly different (P<0.05); T1: Treatment diets were basal diet; T2: basal diet with 200 g/ton virginiamycin powder T3: basal diet with 2 mg/ml black pepper aqueous extract; HDL: High density cholesterol, LDL: Low density lipoprtein

Table 5: The effect of experimental diets on antibody titer and intestinal microbial populations

Treatments	$HI_{(log2)}$	*E. Coli* (cfu/g)	*Lactobacillus* (cfu/gm)
T1	3.40[c]	6.79[a]	4.32[b]
T2	4.11[b]	4.90[c]	4.92[a]
T3	4.46[a]	5.40[b]	4.74[a]
MSE	0.515	0.136	0.124

Means within a row with no common letter are significantly different (P<0.05); T1: Treatment diets were basal diet; T2: basal diet with 200 gm/ton virginiamycin powder T3: basal diet with 2 mg/ml black pepper aqueous extract

2011). Hosseini (2011) showed that black pepper increases digestion through arousing digestive liquids of stomach and eradication of infectious bacteria. Black pepper affects the absorption of nutrients in digestive tract, decreases material transit velocity and increases digestive enzymes which result in higher weight gain (Galib et al., 2011). Herbal plants may provide some compounds that enhance digestion and absorption of some nutrients. Various studies reported an increase in body weight and feed conversion ratio using ginger or black pepper in broiler diet (Ferreira et al., 1990; Al-Harthi et al., 2006). The improvement of birds' performance under pepper supplementation may be associated with its stimulatory, carminative, digestive and anti microbial properties. These findings are in agreement with the other reports (Khalaf et al., 2008; Galib et al., 2011). The pungent compound of *piper nigrum* especially piperine increases the production of saliva and gastric secretions (Malini et al., 1999). The ingestion of peppercorn also increases the production and activation of salivary amylase (Yoshikawa et al.., 1994). The digestive enzymes secretion by the ingestion of *Piper nigrum* probably is due to the stimulatory effect on liver to secrete bile which digests food (Ferreira et al., 1999; Great head, 2003; Herawati, 2011). Al-Harthi (2002) found that feeding chick hot pepper supplemented diet showed an improved feed conversion ratio and concluded that the beneficial effect may be due to its stimulatory, carminative, digestive and antimicrobial properties.

Parks et al. (2009) suggested that virginiamycin controls microbial growth by acting on the mircoflora's biochemical processes such as protein synthesis or inhibiting the elongation of *Methono bacterium* and E. *coli* , or by reducing lactic acid producing bacteria in the stomach. Teymouri-zadeh et al. (2009) and Ahmadi (2011) reported that antibiotics, such as virginiamycin, reduce lactic-acid-producing bacteria, which predominate in the upper gastrointestinal tract of the broiler, while lactic acid producing bacteria help in preventing *Salmonella* (Windisch et al., 2008). The micro-biota in virginiamycin-fed birds represented a virginiamycin-adapted micro-biota (Rahimi et al., 2009).

Several scientific studies provide evidence that black pepper has cholesterol-lowering properties and may help in cardiac function recovery after heart attacks (Akbarian et al., 2012; Zomrawii et al., 2012). Babu and Srinivasan 1997) suggested that such a cholesterol-lowering effect could be mediated by the stimulation of hepatic cholesterol-7- hydroxylase which converts cholesterol to bile acids. Some researcher by *in vitro* trial revealed that aryl hydroxylase activity was reduced by piperine and these findings coincide with hypo cholesterolemic properties of piperine (Srinivasan et al., 2004).

Conclusion

The use of virginiamycin and black pepper extract improved growth and health performance of broiler chicks. These improvements are associated with their biological functions, role as stimulant of feed digestibility, an anti-oxidant, anti-microbial or prevention of gastric toxicity. Although the beneficial effects on health and growth are believed to be mediated by effects on gastrointestinal macrobiotic, the underlying mechanisms remain to be discovered. However further studies on *Piper nigrum* extract are needed.

References

Ahmadi, F. 2011. The Effect of different levels of Virginiamycin on performance, immune organs and

blood metabolite of broiler chickens. *Annals of Biological Research*, 25: 291-298.

Al-Harthi, M.A. 2002. Performance and carcass characteristics of broiler chicks as affected by different dietary types and levels of herbs and spices as no classical growth promote. *Egyptian Poultry Science*, 22: 325-343.

Akbarian, A., Golian, A., Kermanshahi, H., Gilani, A., and Moradi, S. 2012. Influence of turmeric rhizome and black pepper on blood constituents and performance of broiler chickens. *African Journal of Biotechnology*, 11: 8606-8611.

Babu, P.S. and Srinivasan, K. 1997. Hypolipidemic action of curcumin, the active principle of turmeric (Curcuma longa) in streptozotocin induced diabetic rats. *Molecular and Cellular Biochemistry*, 166: 169-175.

Castanon, J.I.R. 2007. History of the use of antibiotic as growth promoters in European poultry feeds. *Poultry Science*, 86: 2466-2471.

Demir, E., Sarica, S., Ozcan, M.A. and Suicmez, M. 2003. The use of natural feed additives as alternative for an antibiotic growth promoter in broiler diets. *British Poultry Science*, 44: 44-45.

Ellefson, R.D. and Garaway, W.T. 1967. Lipids and lipoproteins. In: Fundamentals of Clinical Chemistry. Tietz, W. (Ed). Saunders, W.B. Company. Philadelphia, Pp: 512-514.

Ferreira, S.R.S., Nikolov, Z.L, Doraiswamy, L.K., Meireles M.A.A. and Petenate, A.J. 1999. Supercritical fluid extraction of black pepper (Piper Nigrum L.) essential oil. *Journal of Supercritical Fluids*, 14: 235-245.

Ficker, C.E., Smith, M.L., Leaman, D.L., Irawati, C. and Arnason, J.T. 2003. Inhibition of human pathogenic fungi by member of Zingiberaceae. Used by kenyah Indonesian borneo. *Journal of Ethnopharmacology*, 85: 289-293.

Galib, A., Al-Kassie M., Mamdooh A., Al-Nasrawi, M. and Saba, J.A. 2011. Use of black pepper (Piper nigrum) as feed additive in broilers diet. *Research Opinions in Animal & Veterinary Sciences*, 1: 169-173.

Ghazalah, A.A., El-Hakim, A.S.A. and Refaie, A.M. 2007. Response of broiler chicks to some dietary growth promoters throughout different growth period. *Egyptian Poultry Science*, 27: 53-57.

Great head, H. 2003. Plants and plant extracts for improving animal productivity. *Proceeding of the Nutrition Society*, 62: 279-290.

Herawati, M. 2011. Effect of feeding red ginger as phytobiotic on broiler slaughter weight and meat quality. *International Journal of Poultry Science*, 10: 983-986.

Hosseini, M.N. 2011. Comparison of using different level of black pepper with probiotic on performance and serum composition on broilers chickens. *Journal of Basic and Applied Science Research*, 1: 2425-2428.

Khalaf, A.N., Shakya, A.K., Al-Othman, A., El-Agbar, Z. and Farah, H., 2008. Antioxidant activity of some common plants. *Turkish Journal of Biology*, 32: 51-55.

Malini, T., Arunakaran, J., Aruldhas, M.M. and Govindarajulu, P. 1999. Effects of piperine on the lipid composition and enzymes of the pyruvate malate cycle in the testis of the rat in vivo. *Biochemistry and Molecular Biology International*, 47: 537-45.

Moorthy, M., Ravikumar, S. Viswanathan, K. and Edwin, S.C. 2009. Ginger, pepper and curry leaf powder as feed additives in broiler diet. *International Journal of Poultry Science*, 8: 779-782.

Nalini, N., Manju, Y. and Menon, V. 2006. Effect of spices on lipid metabolism in 1,2-dimethy-lhydrazine-induced rat colon carcinogenesis. *Journal of Medicinal Food*, 9: 237-45.

NRC, 2001. Nutrient Requirement of Poultry. 9th. rev. edition, National Academy Press, Washington.

SAS Institute, 2001. SAS/STAT User's Guide for Personal Computer. 6.12 SAS Institute, Inc., Cary, N.C., USA.

Srinivasan, K., Sambaiah, K. and Chandrasekhar, N. 2004. Spices as beneficial hypo-cholesterolemic food adjuncts: A review. *Food Review International*, 20: 187-220.

Dumonceaux, T.J., Hill, J.E., Hemmingsen, S.M. and Kessel, A.G.V. 2006. Haracterization of Intestinal Micro biota and response to dietary virginiamycin supplementation in the broiler chicken. *Applied Environmental Microbiology*, 72: 2815-2823.

Teymourizadeh, Z., Shaaban, R., Karimi, T.M.A. and Beygir, O. 2009. The effects of Thymus valgaris L., Echinacea parpurea (L.) moench, Allium sativum L. Extracts and virginiamycin antibiotic on intestinal microflora population and immune system in Broilers. *Iranian journal of Medicinal and Aromatic Plants*, 25:39-48.

Weiner, M.A. 1994. Herbal antioxidants in clinical practice. *Journal of Orthomolecular Medicine*, 9: 167-176.

Windisch., W., Schedle, K., Plitzner C. and Kroismayr, A. 2008. Use of phytogenic products as feed additives for swine and poultry. *Journal of Animal Science*, 86: 140-148

Zlatkis, A., Zak, B. and Boyle, A.J. 1993. A new method for the direct determination of serum cholesterol. *Journal of Laboratory Clinical Medicine*, 41: 486-492.

Yoshikawa, M.S., Yamagashi, K., Kumini, H., Matsuda, Y., Okuno, J. and Murakami, N. 1994. Stomachic principle in ginger. Anti-ulcer principle, 6-gingesulfonicacid and three mono Acyl digalactosyglycerols ginger glycolipids A, B and C, from Zingiber rhizome originating in Taiwan.

Chemical & Pharmaceutical Bulletin (Tokyo), 2: 226-230.

Zomrawii, W.B, Abdel Atti, K.H.A., Atti, B.M. Dousa, and Mahala, A.G. 2012. The effect of ginger root powder (*Zingiber officinale*) supplementation on broiler chicks performance, blood and serum constituents. *Online Journal of Animal and Feed Research*, 6: 457-460.