Influence of some natural plants as feed additives on health and growth performance of broiler chickens

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Abstract

The present study was conducted to evaluate the effect of different levels of capsicum and cinnamon as growth promoters on health, growth performance and carcass traits of broiler chickens. A total of 200 one-day-old chicks (Cobb local breed) were reared on floor pens and allocated to five dietary treatments. The first treatment consumed normal broiler diets without any additive and served as a control group. The other 4 dietary treatments contained 1 or 2 g/kg capsicum, 1 or 2 g/kg cinnamon. Feed and water were offered *ad-libitum* for 42 days experimental period. Feed consumption and body weight were recorded weekly to calculate body gain and feed conversion. At day 42, 10 birds were chosen randomly from each group. Blood samples were collected from chosen birds prior to slaughter, then all chosen chicken were subjected to carcass traits examination. Packed cell volume (PCV) and some serum parameters were investigated. Feed intake and live body gain were improved significantly ($p<0.05$) and feed conversion was reduced in broiler chickens receiving 2 g/kg capsicum or cinnamon when compared with the other groups. In groups fed on diets containing 1 g/kg capsicum or cinnamon body weight and live gain were better but non-significantly different from the control group. Carcass yield was not affected by dietary treatments but the abdominal fat in the control group increased significantly ($p<0.05$). There were no differences in the PCV and the analysed serum parameters between the control and experimental groups. The results of this experiment indicated that capsicum and cinnamon have the potential to be applied as growth promoters in broiler diets.

Introduction

The use of antibiotics for growth promotion in poultry species has been banned in many countries and there is a strong possibility that they may face similar legislation in

other areas of the world. Since the early 1950's antibiotics have been widely used in poultry feeds, at first primarily to control diseases and recently to promote growth and improve feed conversion. Use of antibiotics has been severely limited or eliminated in many countries and legislative action to limit their use is probable in many others. Furthermore, withdrawal of antibiotics from poultry products created need for alternative solutions which would influence improvement of health and production traits of broiler chickens. Therefore, alternatives to antibiotics are of great interest in the poultry industry.

Phytogenic additives (phytobiotics) are substances derived from medicinal plants or spices which have positive effect on production and health of animals. As phytobiotics whole plants can be used, parts of plants or essential oils. Phytogenic additives influence positively the consumption and conversion of feed, digestibility and gain of broiler chickens (Ertas et al., 2005). Mechanism of the action of these additives is not completely clear. Some plant extracts influence digestion and secretion of digestive enzymes. They exhibit antibacterial, antiviral and antioxidant effects (Ertas et al., 2005).

The objective of this study was to evaluate the ability of different levels of capsicum and cinnamon to stimulate broiler performance when used as supplements in the diets of broiler chickens.

Material and methods

Two hundred one-day-old broiler chicks of both sexes (Cobb local breed) were weighed and randomly divided into 5 floor pen groups (40 chicks/group). Control group consumed broiler basal diets without any additive and were formulated to meet the requirements of broiler chickens according to Cobb manual catalogue (2000).

Table 1. shows the composition and calculated nutrients profile of the basal diets used. The other 4 groups were fed on the basal diets to which added 1 or 2 g/kg capsicum and 1 or 2 g/kg cinnamon, these additives had no effects on the total nutrient profile of the diets. The diets in the form of mash and water were provided *ad-libitum* for 42 days experimental period. Body weight as well as the rest of feed were recorded weekly. Body weight gain and feed conversion were calculated.

At the end of the experimental period (day 42) 10 birds were chosen randomly from each group. Blood samples were collected from chosen birds prior to slaughter, then all chosen chicken were subjected to carcass traits examination. Blood samples were collected in heparin to determine packed cell volume (PCV), and other samples were collected without anticoagulant for serum separation to estimate serum glutamic oxalic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), Uric acid, alkaline phosphatase and gama-glutamyl transferase. Serum analyses were performed photo-metrically using commercial kits according to the manufacturer's instructions (Merck, Germany).

Table 1. Composition and calculated nutrients profile of the basal diets

Ingredients%	Starter	Grower	Finisher
Corn yellow	51.75	56.20	61.20
Corn gluten meal	5.00	5.00	5.00
Soybean meal (44% CP)	37.30	31.50	25.9
Soy oil	2.20	3.50	4.00
Dicalcium phosphate	1.60	1.60	1.70
Lime stone	1.40	1.45	1.44
Common salt	0.40	0.40	0.40
DL-Methionine	0.05	0.05	0.06
Broiler premix*	0.30	0.30	0.30
Calculated analyses:			
ME (Kcal/kg)	2951.89	3049.55	3124.07
Crude Protein%	23.20	21.29	19.00
Crude fat%	6.00	6.92	8.00
Crude fiber%	4.50	4.8	5.2
Calciun%	1.00	1.00	1.00
Non-phytate phosphorus%	0.45	0.45	0.45

*Per kg premix: 1 200 000 IU vit. A, 350 000 IU vit. D_3, 4 000 mg vit. E, 250 mg vit. B_1, 800 mg vit. B_2, 600 mg vit. B_6, 3.2 mg vit. B_{12}, 450 mg vit. K_3, 4.5 g nicotinic acid, 1.5 g Ca-pantothenate, 120 mg folic acid, 5 mg biotin, 55 g choline chloride, 3 g Fe, 2 g Cu, 10 g Mn, 8 g Zn, 120 mg I, 40 mg Co.

All data of the feeding experiments were statistically analyzed using SPSS® ver. 11 software for PC (2005). Means were compared by one way ANOVA ($P<0.05$), Sendecor and Cochran (1980).

Results and discussion

The effects of different levels of capsicum and cinnamon on performance of broiler chickens are shown in Table 2. Body weight and feed consumption of broilers fed on diets containing 2 g /kg cinnamon or capsicum significantly increased ($p<0.05$). The groups consumed diets containing additives by low dose 1 g/kg had higher body weights compared with the control group but differences were non-significant. Improvement in body weight, supported an earlier hypothesis suggesting that the herbal additives are valued for their beneficial effect on digestion (Grieve, 1981 and Chopra et al., 1992). Furthermore, phytogenic feed additives are often claimed to improve the flavor and palatability of feed, thus enhancing production performance (Jugl-Chizzola et al., 2006; Schoene et al., 2006). Dressing weight showed the same results as live body weight results, dressing weight of broilers fed 2 g /kg cinnamon or capsicum significantly increased ($p<0.05$). On the other hand, carcass yield was not influenced by different levels of capsicum or cinnamon (Table 3). Abdominal fat percentage in broiler chickens receiving capsicum or cinnamon significantly decreased ($p<0.05$).

Table 2. Performance parameters measured (day 42) (Mean ± SD)

Parameter	Control group	Capsicum groups		Cinnamon groups	
		1 g/kg feed	2 g/kg feed	1 g/kg feed	2 g/kg feed
Body weight (g/bird)	1980.5 ± 50.5a	2000.0 ± 20.4a	2110.2 ± 20.2b	2015.7 ± 30.2a	2100.5 ± 25.0b
Body weight gain (g/bird)	1940.5 ± 48.0a	1960.0 ± 18.5a	2070.2 ± 18.0b	1975.7 ± 25.5a	2060.5 ± 20.2b
Feed Intake (g/bird)	3531.7 ± 40.5a	3508.4 ± 51.8a	3457.2 ± 47.2b	3516.7 ± 42.2a	3461.6 ± 5.6b
FCR	1.82	1.79	1.67	1.78	1.68

Figures in the same row with different letters are statistically significantly different ($p<0.05$).

Table 3. Effect of different dietary levels of capsicum and cinnamon on carcass yield, liver weight and abdominal fat content of broiler chickens (day 42) (Mean ±SD)

Parameter	Control group	Capsicum groups		Cinnamon groups	
		1 g/kg feed	2 g/kg feed	1 g/kg feed	2 g/kg feed
Live BW (g)	1960.34 ± 34.2a	1996.9 ± 25.5a	2100.5 ± 15.2b	2000.9 ± 27.3a	2105.3 ± 30.2b
Dressing weight (g)	1491.80 ± 30.2a	1533.62 ± 20.5a	1621.59 ± 22.3b	1530.69 ± 25.4a	1623.19 ± 23.7b
Dressing weight %	76.1	76.8	77.2	76.5	77.1
Liver weight (g)	48.2 ± 3.5	48.9 ± 2.2	50.8 ± 1.9	48.8 ± 3.1	51.1 ± 2.7
Liver weight %	2.46	2.44	2.41	2.44	2.43
Abdominal fat %	2.14a	2.10a	1.82b	2.11a	1.85b

Figures in the same row with different letters are statistically significantly different ($p<0.05$).

Besides efficacy, application of phytogenic feed additives to livestock also has to be safe to the animal, the user, the consumer of the animal products, and the environment. With respect to consumer safety, there is no hazard or undesired residues in animal or poultry products derived from animals fed those natural phytogenic feed. However, metabolic activity (e.g., absorption, potential to accumulate in edible tissues) differs widely among phytogenic compounds, and thus safety needs to be assessed separately for each individual phytogenic feed additive (Baba et al., 2005). Microbiologically, capsicum and cinnamon had powerful antimicrobial and antifungal activities against certain microorganisms known to be pathogenic to broiler chickens, particularly, *Salmonella Spp*., *E. coli*, *Staphylococcus aureus* and *Streptococcus spp.* (Kaushik et al., 2003; Mimica-Dukic et al., 2003; Chang et al., 2001).

Capsaicin and dihydrocapsaicin (compounds identified in capsicum) and Cinnamaldehyde content, eugenol and carvacrol contents (compounds identified in cinnamon) have shown strong antioxidant and antimicrobial activity (Tabak et al., 1999; Matovc and Lavadinovic, 1999; Lidia Dorantes et al., 2000). Therefore, capsicum and cinnamon antimicrobial substances may act as growth promoter which in turn inhibit intestinal pathogenic organisms and improve digestion and absorption.

Table 4. shows the results of PCV and some serum enzymes analyses. Blood and serum enzymes are a useful, sensitive indicator of the bird's general health. The PCV is a simple test which provides fast and general information about the general state of examined whole blood and the bone marrow response. In a normal healthy chicken, the

PCV ranges between 30 – 55% (Gylstorff and Grimm, 1998). The PCV in both control and experimental groups were within the normal physiological limits. The health conditions were coincided with the low values of GOT, GPT, uric acid in serum which indicates that the liver and kidney were in a good functional state. The normal growth of the bone as well as the activity of metabolic processes were verified by the normal physiological limit of serum alkaline phosphatase and gama-glutamyl transferase. Gama-glutamyl transferase is a good mirror for the overall body enzymatic and metabolic processes. These results showed clearly that the general health and metabolic processes of the broiler chickens were not affected by capsicum or cinnamon additives used and the investigated parameters were in the normal averages as mentioned by Gylstorff and Grimm (1998).

Table 4. Packed cell volume and some serum enzyme values (Mean ± SD)

Parameter	Control group	Capsicum groups		Cinnamon groups	
		1 g/kg feed	2 g/kg feed	1 g/kg feed	2 g/kg feed
Packed cell volume (PCV) %	33.5 ± 2.8	32.2 ± 3.4	32.7 ± 2.3	33.1 ± 4.1	32.8 ± 3.6
SGOT (U/I)	115.6 ± 18.0	121.3 ± 14.5	119.5 ± 16.0	112.7 ± 20.1	118.9 ± 16.3
SGPT(U/I)	17.5 ± 6.4	14.8 ± 5.2	13.5 ± 6.0	16.7 ± 8.0	15.4 ± 5.6
Uric acid (mg/dl)	6.2 ± 3.2	7.1 ± 4.0	6.9 ± 5.1	6.5 ± 4.6	6.7 ± 5.5
Alkalline phosphatase (U/I)	275.7 ± 50.4	250.9 ± 43.2	248.4 ± 38.9	245.6 ± 51.2	249.8 ± 55.7
Gama-glutamyl transferase (U/I)	20.3 ± 9.5	21.6 ± 10.2	20.8 ± 8.9	21.0 ± 11.2	22.0 ± 7.6

In conclusion, the results of this experiment demonstrated that capsicum and cinnamon, particularly 2 g/kg have the potential to be applied as growth promoters in broiler diets.

References

Baba, S., Osakabe, N., Natsume, M., Yasuda, A., Muto, Y., Hiyoshi, K., Takano, H., Yoshikawa, T. and Terao, J. (2005). Eur. J. Nutr., 44: 1 – 9.

Chang, S. T., Chen, P.F. and Chang, S.C. (2001). J. of Ethnopharmacology, 77: 123 – 127.

Chopra, R., Nayar, S. and Chopra, I. (1992). Second Glossary of Indian Medicinal Plants. Puplications and information Directorate, New Delhi, India, pp. 414.

Ertas, O.N., Guelert, T., Çiftci, M., Dalkilic, B., Simsek, U.G. (2005). International J. of Poultry Science, 4: 879 - 884.

Grieve, M. (1981). A Modern Herbal. Penguin, UK, pp. 902.

Gylstorff, I and Grimm, F. (1998). Verlag Eugen Ulmer, Stuttgart, Germany, pp. 105 – 134.

Jugl-Chizzola, M., Ungerhofer, E., Gabler, C., Hagmuller, W., Chizzola, R., Zitterl-Eglseer, K. and Franz C. (2006). Munch. Tierarztl. Wochenschr., 119: 238 – 243.

Kaushik, R., Garg, G., Sharma, G. and Arora, C. (2003). Allelopathy J., 12: 205 – 213.

Lidia Dorantes, Colmenero, R., Hernandez, H., Mota, L., Jaramillo, M.E., Fernandez, E. and Solano, C. (2000). International J. of Food Microbiology, 57: 125–128.

Matovc, M. and Lavadinovic, V. (1999). J. Essential Oil Bearing plants, 2: 78 – 81.

Mimica-Dukic, N., Bozin, B., Sokoviae, M., Mihajloviae, B. and Matavulj, M. (2003). Plant Medicine, 69: 413 – 419.

Schoene, F., Vetter, A., Hartung, H., Bergmann, H., Biertumpfel, A., Richter, G., Mueller, S. and Breitschuh, G. (2006). J. Anim. Physiol. Anim. Nutr., 90: 500 – 510.

Snedecor, F.W. and Cochran, W.G. (1980). Iowa state Univ. Press Ames. I.A.

Tabak, M., Armon, R. and Neeman, I. (1999). J. Ethnopharmacology, 67: 269 – 277.