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# Effects of Ginger (*Zingiber officinale*) Oil on Growth Performance and Microbial Population of Broiler Ross 308

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**Abstract:** An experiment was conducted at the University of Kirkuk, poultry farm of college of agriculture department of animal science to evaluate the effect of ginger oil on growth performance and microbial population of broiler chickens. Two hundred male and female day old chicks of Ross308 were arranged in a complete random design experiment and allotted to one of four treatments doses 0 (Control),10mg/kg/day (T1), 20mg/kg/day (T2) and 40mg/kg/day (T3). The trial lasted for seven weeks and there were no differences in feed intake, body weight gain and the feed conversion ratio among the birds, All organs weight and carcass characteristics were not affected by the treatments, except for a decrease ($P<0.05$) in relative liver weight of birds those given ginger oil treatment compared with control. Similarly, a lower ($P<0.001$) proportion of the head weight of birds given ginger oil was observed compared to the control. Dosages effects showed a decrease in relative weight of organs only for the head ($P<0.001$) and the gizzard ($P<0.05$) compared to the control. Male broilers deposited less ($P<0.001$) than the females. There were no significant differences observed in the activities of the serum transaminases (AST and ALT) and blood creatinine level, indicating that none of the three dosages of oil given to birds was toxic. However, *Escherichia coli* and other Enterobacteria counts in the ileo-cæcal digesta numerically decreased ($P<0.05$) compared to the control as the doses of oil given increased. The same observation was made for the *Salmonella* and *Shigella* species ($P<0.001$).The Colony Forming Units (CFU) of *Staphylococci spp* were statistically significantly ($P<0.01$) reduced compared with the control group. Yeast and mold fungi were found in the ileo-cæcal digests of all the groups.

**Key words:** Broiler chickens, ginger oil, growth performance, microbial population

## INTRODUCTION

The high growth rate of broilers and the short live period has been associated by the use of antibiotic growth promoters at doses in animal feeds in order to improve the quality of the product, with a lower percentage of fat containing a relatively high concentration of polyunsaturated fatty acids and a higher protein content of the meat (Kinsella *et al*., 1990; Nettleton, 1991). Other benefits of these compounds include control of zoonotic pathogens such as *Salmonella*, *Campylobacter*, *Escherichia coli* and Enterococci species in the gut (NOAH, 2001). Although birds raised with these feed additives achieved good performance, their potential side effects became a real public health problem worldwide (Bager, 1998; Donoghue, 2003) and led to the ban of these products by the European Union in January 2006. This decision has therefore stimulated a search for alternatives. Essential oils have been proven to control pathogens due to their antimicrobial activity (Dorman and Deans, 2000), to have antioxidative potential (Hui, 1996) by delaying lipid oxidation in broiler meat and to enhance digestion (Brugalli, 2003) by stimulating the endogenous enzymes. It is in this respect that essential oils from ginger (*Zingiber officinale)* supplement were evaluated as natural alternatives to feed antibiotics in broiler diets. Thus, the objective of this study was to investigate the effects of different dosages of essential oils from the plant on some blood parameters, intestinal microflora population and growth performance of broiler chickens.

## MATERIALS AND METHODS

**Experimental birds and management:** Two hundred twenty five day old Ross308 chicks, with equal numbers of males and females were kept in a brooding house for 21 days under a decreasing room temperature regime that was reduced from 32°C during the first week of life to 26°C at three weeks. The chicks were given vitamins from the first to the third day of age and before, during and after the vaccinations. In order to boost their immunity they were vaccinated against Newcastle disease and infectious bronchitis on the seventh and 25th days of age, while Gumboro vaccine was administered on the tenth day of the experiment. Birds

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Table 1: Diet formulation and compositions (%)

| Ingredients | Starter (0 to 21d) | Grower (22 to 42d) |
|---|---|---|
| Corn | 58.40 | 63.80 |
| Soybean meal (43% CP) | 33.70 | 28.20 |
| oil | 2.90 | 3.00 |
| Fish meal (60.2% CP) | 1.50 | 1.50 |
| Dicalcium phosphate | 1.40 | 1.40 |
| Limestone | 1.20 | 1.20 |
| Salt | 0.21 | 0.21 |
| dl-Met | 0.19 | 0.19 |
| Vitamin-mineral premix | 0.50 | 0.50 |
| Calculated composition ME, kcal/kg | 3,049 | 3,095 |
| CP, % | 21.00 | 19.05 |
| Calcium, % | 0.96 | 0.94 |
| Total phosphorus, % | 0.68 | 0.64 |
| Lys, % | 1.13 | 0.97 |

received feed and watered libitum every day. The experiment lasted for seven weeks during which feed intake, weekly weight gain and feed conversion ratio were monitored.

**Feed preparation and feeding:** The ingredient and calculated chemical composition of the basal diets are shown in Table 1 for the starter and finisher growth periods respectively. The diets were formulated to meet the nutrient requirements of growing broilers.

**Experimental design, data collection and statistical analysis:** The ginger oil add to birds started from the first day right to the end of the experiment. The chicks were given four treatments (0 mg/kg/day ginger oil (Control), 10 mg/kg/day (T1), 20 mg/kg/day (T2) and 40 mg/kg/day (T3), respectively. They were arranged in a complete random design experiment. Each dosage consisted of three replicates with a male and a female chick per replicate in litter pens for the all period. The data was tested by Duncan Multiple range and F-test (Duncan, 1955).

**Determination of the Tran's aminase (AST and ALT) activities and creatinine level in the serum:** Blood samples were collected from the jugular vein of birds stunned before slaughter using non-heparinized tubes and immediately subjected to centrifugation at 2000 revolutions per minute for 15 minutes to obtain blood serum. Alanine amino transfers and Aspartate amino transfers activities and creatinine levels in samples of blood serum obtained were determined using commercial kits (Bio system Reagents and Instruments).

## RESULTS AND DISCUSSION

**The results of gas chromatography coupled with Mass Spectrometry (GM/MS) analyses of the oils are summarized in Table 2:** The main constituents identified in ginger oil, 26 constituents were identified, with zingiberene, sabinene, camphene, geraniol, z-citral and 1,8-cineole as major components, These results agree with the findings of Suad Khamis *et al*. (2004) in terms of the major constituents in ginger essential oils but are respectively higher and lower with regards to the highest percentage content of major components.

Table 2: Chemical composition (%) of the essential oil of *Zingiber officinale*

| Library/ ID | Percent in oil |
|---|---|
| α-pinene | 4.1 |
| Camphene | 11.9 |
| 2-β-pinene | 0.3 |
| 6-methyl-5-hepten-2-one | 1.1 |
| B-myrcene | 1.7 |
| 1-phellandrene | 0.6 |
| Sabinene | 12.0 |
| 1,8-cineole | 5.3 |
| α-terpinolene | 0.4 |
| 2-nonanone | 0.6 |
| α-terpinolene | 1.7 |
| Citronellal | 0.4 |
| endo-borneol | 1.9 |
| β-fenchyl alcohol | 0.8 |
| 6-octen-1-ol, 3,7-dimethyl | 0.9 |
| z-citral | 8.2 |
| Geraniol | 2.6 |
| Geraniol | 10.0 |
| 2-undecanone | 0.8 |
| citronellyl acetate | 0.3 |
| ar-curcumene | 2.5 |
| Germacrene | 0.8 |
| Zingiberene | 14.0 |
| Farnesene | 4.4 |
| β-bisabolene | 2.6 |
| β-sesquiphellandrene | 4.8 |

There were no significant differences among treatments for Daily Feed Intake (DFI), Daily Weight Gain (DWG) and Feed Conversion Ratio (FCR), or in the interaction between treatments and dosages, indicating that the factor acted independently on the growth performance Table 3.

Similarly, all offal's and organs expressed as a proportion of body weight and the carcass characteristics of birds were not affected by treatment and dosage except liver Table 4.

These results agree with the findings of Jayalakshmi *et al*. (2006), who studied the influence of sunflower acid oil usage on production performance, carcass traits and economics of broilers and reported no significant differences in body weight gain, cumulative feed consumption, cumulative feed conversion ratio and liveability between treatment groups from the first week till the end of experiment. Similarly, Botsoglou *et al*. (2002) observed that supplementation of broiler feed with oregano essential oil for thirty eight days had no growth-promoting effects.

These findings agree with the reports of Tubtim and Wasiksiri (2007), who subjected male and female Sprague-Dawley rats to a 28-day repeated dose oral

Table 3: Effect of ginger oils on the growth performance of broiler

| | Mean values for treatment and dosage* | | | | |
|---|---|---|---|---|---|
| Parameters | Control | $T_1$ | $T_2$ | $T_3$ | Level of significance |
| Daily feed intake, g/bird | 105 | 104 | 102 | 103 | NS |
| Daily weight gain, g / bird | 42.9 | 38.7 | 41.3 | 40.9 | NS |
| Feed conversion ratio | 2.44 | 2.67 | 2.47 | 2.52 | NS |
| Mortality | 0.00 | 0.00 | 1.00 | 1.00 | NS |

*Mean values in the same row without superscripts are not significantly different (ns). $T_1$= Ginger essential oil at 10mg/kg/day; $T_2$= Ginger essential oil at 20mg/kg/day; $T_3$= Ginger essential oil at 40mg/kg/day

Table 4: Mean values for effect of ginger oils dosage on carcass characteristics, offal's and organs expressed in % body weight

| | Control | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|
| Live weight | 1822 | 1876 | 1880 | 1890 |
| Carcass weight | 1243 | 1280 | 1265 | 1287 |
| Heart weight | 0.38 | 0.39 | 0.37 | 0.39 |
| Liver weight | $1.32^b$ | $1.66^a$ | $1.77^a$ | $1.80^a$ |
| Abdominal fat | 0.29 | 0.32 | 0.28 | 0.29 |
| Pancreas weight | 0.22 | 0.21 | 0.22 | 0.22 |
| Gizzard weight | 1.45 | 1.54 | 1.69 | 1.66 |
| Leg weight | 3.43 | 3.66 | 4.52 | 3.55 |
| Head weight | 3.45 | 3.43 | 3.76 | 2.63 |

$^{a-b}$Mean values within rows without superscripts are statistically similar

Table 5: Sex effects of and oil on gut microbial counts, on the activities of serum alanine amino transferase (ALT), serum aspartate amino transferase (AST), blood creatinine level and on carcass characteristics, offals and organs expressed in % of body weight

| Parameters | Male | Female | Level of Significance |
|---|---|---|---|
| Live weight | 2135±55.8 | 1790±47.6 | p<0.01 |
| Carcass weight | 1543±36.6 | 1321±32.6 | p<0.01 |
| Dressing percentage | 72.7±0.78 | 70.43±0.68 | Ns |
| Heart weight | 0.46±0.14 | 0.43±0.11 | Ns |
| Liver weight | 1.77±0.34 | 1.88±0.35 | Ns |
| Pancreas | 0.25±0.03 | 0.25±.0.02 | Ns |
| Gizzard weight | 1.34±0.23 | 1.66±0.11 | Ns |
| Abdominal fat | 11.21±0.23 | 6.26±0.77 | p<0.001 |
| Head weight | 2.85±0.31 | 2.76±0.22 | ns |
| Legs weight | 4.43±0.21 | 3.56±0.24 | p<0.001 |
| Staphylococci count | $2.34\times10^{-3}$±0.00 | $3.12\times10^{-3}$±0.00 | p<0.05 |
| *Salmonella* and *Shigella* species | $1.03\times10^{-3}$±0.00 | $7.33\times10^{-4}$±0.00 | p<0.05 |
| *Escherichia coli* and other Enterobacters | $4.93\times10^{-3}$±0.01 | $5.54\times10^{-3}$±0.02 | ns |
| Blood creatinine level | 0.47±0.03 | 0.38±0.02 | ns |
| AST activity | 11.23±5.43 | 18.87±4.67 | ns |
| ALT activity | 8.12±2.55 | 11.34±2.43 | ns |

toxicity study with *Litsea cubeba* essential oil and obtained changes in relative liver and kidney weights in certain treated groups compared with the control. Dosage effects also exclusively affected the head weights Table 8.

The relative head weights of birds given different dosages of essential oils were statistically similar but significantly (P<0.001) lower compared to the controls. These results are consistent with those observed by Barreto *et al*. (2008), who assessed the efficacy of different plant extracts as alternatives to antimicrobial growth promoters in broiler diets and reported no effects of experimental treatments on organs morphometric, except for a lower liver relative weight (P<0.05) of birds fed the diet containing red pepper extract which showed the lowest change in relative liver weight compared to those on the control diet, the sex effects of essential oils on the parameters studied are shown in Table 5.

**Enzymes activities in the serum, creatinine level in the blood and microflora enumeration:** The details of treatments and dosages effects of oil on enzymes activities in the serum, creatinine level and on the gut microbial load are shown in Tables 5. The effect of essential oil treatments on the aspartate amino transferase activity, alanine amino transferase activity and creatinine level in the blood did not differ from the control. Similarly, Shanoon (2011) administered different doses of ginger to male and female of broiler breeder and obtained no significant difference from the control group for these same blood parameters.

There was a significant decrease (P<0.001) in the number of Colony Forming Units (CFU) of *Escherichia coli* and other enterobacteria in digesta of ileo-cecum, compared with the control as the dosage of essential oils used increased. The same observation was made for the *Salmonella* and *Shigella* species (P<0.05).

The counts of *Staphylococci spp* did not differ between the oil treated groups of birds but were significantly (P<0.001) reduced as compared to the control. These findings Similarly to Hinton and Linton (1988), Izat *et al.* (1990), Oliveira (1996) and Byrd *et al.* (2001) demonstrated that the addition of lactic acid, formic acid and propionic acid to diets and drinking water efficiently controlled *Salmonella and Shigella* species, *Escherichia coli*and other Enterobacteria in poultry. Yeast and mold fungi were also found in the ileo-cecal digesta of all the groups.

Female birds put on more (P<0.001) abdominal fat and had more zoonotic pathogens in their gut than the males (Pym and Solvyns, 1979; Broadbent *et al.*, 1981; Ross Breeders, 1996; Rondelli *et al.*, 2003). However, the carcasses and the legs of male broilers weighed more than those of females. There were no significant differences in the activities of blood parameters and organs such as the gizzard, pancreas, liver and the heart between male and female birds.

These results agree with the reports of Souza *et al.* (1995), who evaluated the carcass traits of four commercial broiler lines, Arbor Acres, Hubbard, Cobb and Ross, under the same nutritional management and found higher leg and thigh yield in Hubbard males and higher breast yield in the Ross line.

## REFERENCES


Bager, F., 1998. Consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals. Food and humans in Denmark, Dansk, Copenhagen, Zoonocenter, Denmark.

Barreto, M.S.R., J.F.M. Menten, A.M.C. Racanicci, P.W.Z. Pereira and P.V. Rizzo, 2008. Plant extracts used as growth promoters in broilers. Revista Brasileira de Ciência Avicola. Volume 10No.2 Campinashttp://www.scielo.br/scielo.php?pid=S1516-635X2008000200006&script=sci_arttext

Botsoglou, N.A., P. Florou-Paneri, E. Christaki, D.J. Fletouris and A.B. Spais, 2002. Effect of dietary oregano essential oil on performance of chickens and on iron-induced lipid oxidation of breast, thigh and abdominal fat tissues. Br. Poult. Sci., 43: 223-230.

Broadbent, L.A., B.J. Wilson and C. Fischer, 1981. The composition of the broiler chickens at 56 days of age: output, components and chemical composition. Br. Poult. Sci., 22: 385-390.

Brugalli, I., 2003. Alimentação alternativa: a utilização de fitoterápicos ou nutracêuticos como moduladores da imunidade e desempenho animal. Anais do Simposio sobre Manejo e Nutrição de Aves e Suínos; Campinas, São Paulo. Brasil. Campinas: CBNA; pp.167-182.

Byrd, J.A., B.M. Hargis, D.J. Caldwell, R.H. Bailey, K.L. Herron, J.L. McReynolds, R.L. Brewer, R.C. Anderson, K.M. Bischoff, T.R. Callaway and L.F. Kubena, 2001. Effect of lactic acid administration in the drinking water during preslaughter feed withdrawal on Salmonella and Campylobacter. Poult. Sci., 80: 278-283.

Donoghue, D.J., 2003. Antibiotic residues in poultry tissues and eggs: Human health concerns? Poult. Sci., 82: 618-621.

Dorman, H.J.D. and S.G. Deans, 2000. Antimicrobial agents from plants: Antibacterial activity of plant volatile oils. J. Applied Microbiol., 88: 308-316.

Duncan, D.B., 1955. Multiple range and F-test. Biometrics 11: 1-42.

Hinton, R.H. and A.H. Linton, 1988. Control of Salmonella infections in broilers chickens by the acid treatment of their feed. Vet. Rec., 123: 416-421.

Hui, Y.H., 1996. Oleoresins and essential oils. In: Hui YH, editor. Bailey's industrial oil and fat products. New York: Wiley-Interscience Publication; cap. 6, pp: 145-153.

Izat, A.L., N.M. Tidwell, R.A. Thomas, M.A. Reiber, M.H. Adams, M. Colberg and P.W. Waldroup, 1990. Effects of a buffered propionic acid in diets on the performance of broiler chickens and on the microflora of the intestine and carcass. Poult. Sci., 69: 818-826.

Jayalakshmi, N.S., R. Mathivanan, R. Amutha, S.C. Edwin and K. Viswanathan, 2006. Production performance and carcass traits of broilers fed with sunflower acid oil. Int. J. Poult. Sci., 5: 890-894.

Kinsella, J.E., B. Lokesh and R.A. Stone, 1990. Dietary n-3 polyunsaturated fatty acids and amelioration of cardiovascular disease: Possible mechanism. Am. J. Clin. Nutr. 52: 1-28.

NOAH (National Office of Animal Health), 2001. Antibiotics for animals.http://www.noah.co.uk/issues/antibiotics.htm Last accessed 28 October 2001.

Nettleton, J.A., 1991. n-3 Fatty acids composition of plant and seafood sources in human nutrition. J. Am. Dietetic Assoc., 91: 331-337.

Oliveira, E.O., 1996. Uso de acidos graxos de cadeia no controle de*Salmonella*emragoes de aves. Piracicaba. USP/ESALQ, p.72 (Dissertagao-Mestrado).

Pym, R.A.E. and A.J. Solvyns, 1979. Selection for food conversion in broilers: Body composition of birds selected for increased body-weight gain, food consumption and food conversion ratio. Br. Poult. Sci., 20: 87-97.

Rondelli, S., O. Martinez and P.T. Garcia, 2003. Sex effect on productive parameters, carcass and body fat composition of two commercial broilers lines. Revista Brasileira de Ciência Avicola., 5: 3Campinas.

Ross Breeders (RB), 1996. Producing quality broiler meat. Ross broiler management manual. Ross Breeders Limited, Midlothian, United Kingdom.

Shanoon, A.K., 2011. Effects of *Zingiber officinale* powder on Semen Characteristic and Blood serum sex hormones concentration in broilers Breeder Male. Int. J. Poult. Sci., 10: 629-633.

Souza, P.A., H.B.A. Sousa, E.F. Campo and E. Brognoni, 1995. Desempeño y características de carcasa de diferentes líneas comerciales de pollos parrilleros.XIV Congreso Latinoamericano de Avicultura. Chile., pp: 108-118.

Khamis, S., S. Al-Burtamani, O.M. Fatope, R.G. Marwah, A.K. Onifade and S.H. Al-Saidi, 2004. Chemical composition, antimicrobial and antifungal activities of the essential oil of *Haplophyllum tuberculatum*from Oman. J. Ethnopharmacol., 96: 107-112.

Tubtim, S. and A. Wasiksiri, 2007. 28-day repeated dose oral toxicity study of*Litseacubeba*essential oil in Sprague-Dawley rats. Thailand J. Pharmacol. Sci., 31: 74-82.