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# EFFECT OF DIETARY GINGER AND CINNAMON OILS SUPPLEMENTATION ON GROWING JAPANESE QUAIL PERFORMANCE

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**ABSTRACT:** This experiment was conducted to study the effect of dietary antibiotic and essential oil supplementation on growth performance [live body weight (LBW), daily body weight gain (LBWG), feed intake (FI) and feed conversion ratio (FCR)] and carcass characteristics of growing Japanese quail. A total number of 360 one week old Japanese quail chicks were randomly distributed into 8 treatment groups each of 45 chicks with three replicates (15 chicks each). Chicks of all experimental groups had nearly the same average initial weight. The 1st group was fed the basal diet without supplementation as control, the 2nd was fed the basal diet supplemented with 0.50g antibiotic (colistine)/kg diet. The 3rd and 4th groups were fed the basal diet supplemented with 0.50 ml and 1.0 ml ginger oil (GO)/kg diet, respectively. The 5th and 6th groups were fed the basal diet supplemented with 0.5 ml and 1.0 ml cinnamon oil (CO) /kg diet, respectively. The 7th and 8th groups were fed the basal diet supplemented with 0.50 ml and 1.0 ml /kg mixture of GO plus CO (1:1), respectively. Results showed that chicks received 0.25 ml GO and 0.25 ml CO/kg diet had significantly (P<0.05) higher LBW compared with those received 0.5 g antibiotic /kg diet. Daily body weight gain significantly (P<0.05) increased when birds received diets containing different levels of GO or CO and 0.25 ml GO +0.25 ml CO/kg diet as compared with birds received 0.5 g antibiotic/kg diet. No significant differences in feed intake were recorded among dietary treatments during all the studied experimental period (1-3, 3-5 and 1-5 weeks of age). The better feed conversion ratio (FCR) value was recorded by chicks fed diet supplemented with 1.0 ml CO/kg diet, while the poorest FCR value was recorded by chicks fed 0.5 g antibiotic /kg. In addition, percent of carcass, dressing and gizzard were significantly (P<0.01) affected by dietary treatments. It could be concluded that GO and CO could act as a good alternative to antibiotics (colistine) in growing Japanese quail diets.

**Key words:** quail, ginger, cinnamon oils, growth performance.

## INTRODUCTION

Poultry industry aims to produce high quality product at low cost. In addition to increasing demand for poultry meat, continuous, effective and targeted healthcare is required to prevent the development of diseases. The poultry industry is under increasing pressure to produce good quality and high quantitative products for consumers. Antibacterial food additives have been used as antibiotics throughout the world for years, as growth promoter stimulated to control and prevent pathogenic bacteria in the intestinal mucosa to improve the production of meat and egg. However, mis-using of antibiotics in poultry production has become undesirable due to their residues of meat products (**Burgat, 1991**) and the development of antibiotic-resistant bacteria in humans (**Sahin *et al*., 2002**). Since January 2006, the European Union has banned the use of antibiotics as a promoter of growth (**Eckert *et al*., 2010**). Herbal extracts considered as herb-derived compounds which are mixed with animal food to enhance the performance of animal growth and the quality of the product. They are categorized in reference to their origins and active principles: extracts, spices, aromatic oils (lipophilic compounds derived by steam distillation of grasses), and

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olives (compounds derived with non-hydrolysis solvents) (**Windisch *et al.*, 2007)**.

Medicinal plants such as ginger (*Zingiber officinale*) and cinnamon (*Cinnamomum verum*) are used in various forms and additives and maintain the digestive balance of the existing flora. In addition, these play a functional role by increasing the secretion of specific enzymes and exerting antibacterial effects (**Boyraz and Ozcan, 2006; Ghazalah and Ali, 2008**). Cold-pressed ginger and cinnamon oils are good source of nutritionally valuable contents, natural antioxidants, essential fatty acids, and lipid-soluble bioactive molecules. Tocols and phenolics display nutritional importance as natural antimicrobials and antioxidants and may directly react with, and quench, free radicals to prevent lipid peroxidation, thereby improving health and preventing certain diseases (**Abo El-maati *et al.*, 2016**).

The use of medicinal plants, cold-pressed oils, and their bioactive constituents is gaining importance in poultry and animal production, given their beneficial effects on the growth and production, immune system, and health (**Farag *et al.*, 2014**). The essential oils from ginger and cinnamon exhibit antiseptic, anti-inflammatory, and antioxidant activities and acts as an appetite and digestion stimulant (**Kamel, 2001; Dragland *et al.*, 2003**).

The objective of this study was to investigate the effect of different levels of ginger and cinnamon oils as natural alternatives as will as feed antibiotics on growth performance and carcass traits of growing Japanese quail.

## MATERIALS AND METHODS

The present study was carried out at Poultry Research Farm, Poultry Department, Faculty of Agriculture, Zagazig University, Egypt. A total number of 360 one week old Japanese quail chicks were randomly divided into 8 treatment groups, each of 45 chicks (3 replicates/15 chicks).

The 1st group was fed the basal diet without supplementation as control, The 2nd was fed the basal diet supplemented with 0.50g antibiotic (Colistine)/ kg diet. The 3rd and 4th groups were fed the basal diet supplemented with 0.50 ml and 1.0 ml ginger oil (GO)/kg diet. The 5th and 6th groups were fed the basal diet supplemented with 0.5 ml and 1.0 ml cinnamon oil (CO)/kg diet, respectively. The 7th and 8th groups were fed the basal diet supplemented with 0.50 ml and 1.0 ml /kg mixture of GO plus CO /kg (1:1), respectively. The basal diet was formulated according to **NRC (1994**). The composition and chemical analysis of the basal experimental diet are shown in Table 1.

Birds were kept in battery cages with dimensions of 40×40×40 cm, all groups were kept under the same managerial and hygienic conditions. Feed and water were offered *ad libitum*. The experimental period was extended for 5 weeks (1-5 weeks of age). Artificial light source was used giving a total of 23 L/D hours of light per day during the experimental period for each replicate, live body weight and feed consumption were weighted weekly. Body weight gain and feed conversion ratio (g feed/g gain) were calculated.

At the end of the experimental period (5 weeks of age) three chicks from each treatment group were taken randomly, fasted overnight, weighted and slaughtered by sharp knife to complete bleeding followed by plucking the feather and finally weighted. The carcass traits studies were carcass and giblets (liver, gizzard and heart) percentages and dressing percentages (carcass weight plus giblet weight)/pre-slaughter weight x 100.

### Statistical Analysis

The experiment was designed in a completely randomized design. While obtained data were subjected to the ANOVA procedure for a completely randomized design using the GLM procedures of SAS software (**SAS, 2002)** . The statistical model was:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where $Y_{ij}$ = an observation, $\mu$ = the overall mean, $T_i$ = effect of treatment and $e_{ijk}$= random error. The differences among means were determined using the post-hoc Newman-Keuls test. Statements of statistical significance are based on $P < 0.05$.

**Table 1. Composition and calculated analysis of the basal diet**

| Ingredients (%) | |
|---|---|
| Yellow Corn (8.5%) | 53.03 |
| Soybean meal (44%) | 38.69 |
| Gluten meal (62%) | 3.20 |
| Soybean oil | 1.67 |
| Di Calcium phostphate | 0.81 |
| Limestone | 0.30 |
| Vit-min Premix* | 0.30 |
| NaCl | 0.11 |
| DL Methionine (58%) | 0.39 |
| L-Lysine HCl(119%) | 1.50 |
| Total | 100 |
| Calculated analysis**: | |
| CP (%) | 24.04 |
| ME Kcal/kg | 2903 |
| Ca (%) | 0.85 |
| P (Available) (%) | 0.45 |
| Lysine (%) | 1.60 |
| Meth. + Cys. (%) | 0.88 |
| CF (%) | 3.92 |

* Growth vitamin and Mineral premix Each 2 kg consists of :Vitam. A 12000, 000 IU; Vitam. D3, 2000, 000 IU; Vitam. E. 10g; Vitam. k3 2 g; Vitam. $B_1$, 1000 mg; Vitam. $B_2$, 49g ; Vitam. $B_6$, 105 g; Vitam. $B_{12}$, 10 mg; Pantothenic acid, 10 g; Niacin, 20 g , Folic acid , 1000 mg ; Biotin, 50 g; Choline Chloride, 500 mg, Fe, 30 g; Mn, 40 g; Cu, 3 g; Co, 200 mg; Si, 100 mg and Zn , 45 g.

** Calculated according to **NRC (1994).**

# RESULTS AND DISCUSSION

## Growth Performance

### Live body weight (LBW) and daily body weight gain (DBWG)

Live body weight (LBW) and daily body weight gain (DBWG) are presented in Table 2. The obtained results of LBW revealed significant ($P<0.05$) among dietary treatments at 3 and 5 weeks of age. At 3 weeks of age, results presented show that, chicks received 0.25 ml GO and 0.25 ml CO/kg diet had significantly ($P<0.05$) higher LBW compared with those received either 0.5 g antibiotic/kg diet or control diet, but not significantly differed other dietary treatments.

Results in Table 2 prove that LBW at 5 weeks of age was significantly ($P<0.05$) increased of chicks fed diets supplemented by different levels of GO or CO and 0.25 ml GO + 0.25 ml C /kg diet when compared with group fed 0.5 g antibiotic/kg diet. However, there was insignificant effect with control and chicks fed diet supplemented with 0.50 ml GO + 0.50 ml CO/ kg diet.

**Table 2. Live body weight and body weight gain ($\overline{X}$ ±SE) for growing Japanese quails as affected by dietary ginger and cinnamon oils supplementation**

| Item | Live body weight (g) | | | Body weight gain (g/ bird/ day) | | |
|---|---|---|---|---|---|---|
| | Initial (1 week) | 3 weeks | 5 weeks | 1-3 weeks | 3-5 weeks | 1-5 weeks |
| **Control** | 36.13 ± 0.08 | 101.93$^{b}$ ± 3.47 | 197.84$^{ab}$ ± 3.14 | 4.70 ± 0.25 | 6.85 ± 0.12 | 5.78$^{ab}$ ± 0.11 |
| **Antibiotic (0.5g/kg diet)** | 36.22 ± 0.27 | 100.74$^{b}$ ± 0.68 | 191.50$^{b}$ ± 1.72 | 4.61 ± 0.03 | 6.49 ± 0.12 | 5.55$^{b}$ ± 0.06 |
| **0.5 ml GO/kg** | 36.40 ± 0.27 | 102.53$^{ab}$ ± 1.19 | 203.05$^{a}$ ± 3.85 | 4.69 ± 0.11 | 7.22 ± 0.36 | 5.95$^{a}$ ± 0.13 |
| **1.0 ml GO/kg** | 36.18 ± 0.36 | 104.45$^{ab}$ ± 0.91 | 206.43$^{a}$ ± 2.66 | 4.88 ± 0.05 | 7.28 ± 0.25 | 6.08$^{a}$ ± 0.10 |
| **0.5 ml CO/kg** | 36.09 ± 0.16 | 103.02$^{ab}$ ± 1.41 | 202.60$^{a}$ ± 1.87 | 4.78 ± 0.09 | 7.11 ± 0.20 | 5.95$^{a}$ ± 0.06 |
| **1.0 ml CO/ kg** | 36.27 ± 0.21 | 104.99$^{ab}$ ± 1.75 | 205.29$^{a}$ ± 3.47 | 4.91 ± 0.11 | 7.16 ± 0.36 | 6.04$^{a}$ ± 0.13 |
| **0.25 ml GO+ 0.25 ml CO/kg** | 36.71 ± 0.04 | 106.38$^{a}$ ± 0.57 | 204.11$^{a}$ ± 3.52 | 4.98 ± 0.04 | 6.98 ± 0.24 | 5.98$^{a}$ ± 0.13 |
| **0.50 ml GO+ 0.50 ml CO/kg** | 35.96 ± 0.39 | 104.36$^{ab}$ ± 1.04 | 197.78$^{ab}$ ± 2.14 | 4.88 ± 0.07 | 6.67 ± 0.18 | 5.78$^{ab}$ ± 0.06 |
| **F. test** | NS | * | * | NS | NS | * |

- GO: ginger oil; CO: cinnamon oil.

Means in the same column within each classification bearing different letters are significantly different. *= significant (P<0.05) and NS = Not significant.

Regarding to DBWG, results illustrated in Table 2 summarize the influence of supplemented different levels of GO or CO and its mixture in Japanese quail diets, from 1 to 5 weeks of age. It could be noticed that, the average DBWG during 1-5 weeks of age followed nearly the same trend observed with LBW at 5 weeks of age, whereas, DBWG significantly (P<0.05) increased of birds received diets containing different levels of GO or CO and 0.25 ml GO +0.25 ml CO /kg diet as compared by birds received 0.5 g antibiotic /kg diet. It is worthy noting that, statistical analysis did not show any significant effect on DBWG of Japanese quail chicks, due to the addition of antibiotic and essential oils in the diets at 1-3 and 4-5 weeks of age (Table 2).

From the previous results it could be concluded that, dietary supplementation of 0.5 ml and 1.0 ml /kg diet of GO and CO or their mixture with level 0.25 ml GO + 0.25 ml CO /kg diet insignificantly improved LBW at 5 weeks of age and DBWG through 1-5 weeks of age when compared with control and group fed diet containing 0.5 ml GO +0.5 ml CO /kg. The improvement in LBW and DBWG due to GO or CO supplementation could be attributed to its positive effect on nutrient digestibility, as reported by **Cabuk *et al.* (2003 and 2006)**, as well as their probable antioxidants and antimicrobial effects in the intestine and thus digestive system (**Nascimento *et al.*, 2000; Ertas *et al.*, 2005**). The better improvement of LBW and BWG with dietary GO and CO mixture may be related to the synergistic effects of combination of GO and CO (**Williams and Losa, 2001). Lambert *et al.* (2001**), **Burt (2004) and Erdelyi *et al.* (2008**) reported that the combination of thymol and carvacrol or any other specific combinations of essential oils (EO), secondary metabolites exhibited higher antibacterial activity than either compound alone which mainly due to the additive antagonistic and synergistic effects of these two compounds. Also, **Jang *et al.* (2004)** showed that broiler chicks which assigned to diet supplemented with a blend of essential oil combined with lactic acid showed significant increase in digestive enzyme activities of the pancreas and intestinal mucosa which leading to an increase in growth performance. Current results agree with those of **Alcicek *et al.* (2003)** who used essential oil combination in broiler diet, **Jamroz *et al.* (2003)** who used plant extract (capsaicin, carvacol and cinnamaldhyde) on one day old broiler chicks, **Denli *et al.* (2004**) who used thymol or black seed oil in quail feed, **Ocak *et al.* (2008)** who

added peppermint in broiler diets from 7 to 35 days of age, **Isabel and Santos (2009)** who used clove and cinnamon in broiler chick diet. **Ertas *et al.* (2005)** used different levels of essential oil mixtures 100, 200 and 400 ppm/kg diet in day old chickens. They found that the highest LBW was observed in 200 ppm group essential oil mixture and DBWG in 200 ppm group which increased by nearly 16% over the un-supplemented control groups. Also, **Abd El-Hady *et al.* (2013)** investigate the addition effects of 300 or 400 mg /kg diet of digestarom peppermint fennel and caraway to basal diet. They found that, addition of 400 mg digestarom recorded the higher final body weights (P<0.05) by 6.6% than that of control one.

Contradicting results were obtained by some investigators, showed that addition of some essential oil with low level and sometimes with higher level than suitable for kind of animal age, diet, *etc*. did not positively effect on animals performance. Different levels of cinnamon powder (250, 500, 1000 or 2000 mg/kg) (**Koochaksaraie *et al.*, 2011**) or cinnamon oil (500-1000 ppm), (**Ciftci *et al.*, 2009)** appear not to have a significant effect on growth performance of broilers. **Barreto *et al.* (2008)** have reached the same conclusions after the incorporation of cinnamon extract (1000 ppm) in broiler chick diets. **Symeon *et al.* (2014)** suggest that cinnamon oil at the selected concentrations may not have the potential to improve broiler growth performance. **Rahimi *et al.* (2011)** reported that chicks fed diet supplemented with 15 ppm virginiamycin had better BW and BWG than those fed diet supplemented with 0,1% aqueous extract of garlic. **Ramadan (2013)** showed insignificant difference in productive performance between thyme and antibiotic groups.

**Feed intake (FI) and feed conversion ratio (FCR)**

Concerning FI of Japanese quails, results obtained showed no significant differences between dietary treatments during all the experimental period studied (1-3, 3-5 and 1-5 weeks of age) as shown in Table 3. The results obtained may be attributed to that the tested bioactive components in different tested levels did not depress or stimulate the appetizing effects on feed consumption of broiler chicks (**Halle *et al.*, 2004; Cabuk *et al.*, 2006; Cho *et al.*, 2006**). Results obtained agree with those of **Ertas *et al.* (2005)** who used different levels of essential oil mixtures (100, 200 and 400 mg EO mixture/kg feed) in day old broiler chicks and found insignificant effect on feed intake among levels. Similar results were obtained by **Zhang *et al.* (2005)** who used 150 g /ton of commercial product (repaxol) a mixture of EO (oregano, cinnamon, thyme and capsicum).

In contrast some workers indicated that, addition higher levels of essential oils to diets depressed feed intake (**Halle *et al.*, 2004**). **Cabuk *et al.* (2006)** reported that using 24 or 48 mg essential oil mixture in broiler diets. Daily feed intake up to 21 days of broilers was significantly reduced as result of inclusion the essential oil mixture in their diets.

On the other hand, many investigators reported the stimulating and appetizing effects of essential oils on feed consumption for broilers. **Cho *et al.* (2006)** found that addition of commercial essential oils (Fresta F.coc) at a level of 0.03% in broiler chick diets improved daily feed intake.

Regardless to FCR, results illustrated in Table 3. Summarize the influence of dietary treatments on FCR during the period from 1 to 5 weeks of age.

Feed conversion ratio during 1-3 weeks of age was not significantly affected by dietary treatments but it significantly affected during 3-5 and 1-5 weeks of age (Table 3). At 4-5 weeks of age FCR was significantly (P<0.05) improved in the chicks fed diet supplemented with different levels of GO or CO and 0.25 ml GO + 0.25 ml CO /kg diet when compared with chicks fed 0.5 g antibiotic /kg diet, but it not significantly differed with control and chicks fed diet containing 0.5 ml GO + 0.5 ml CO. At 1-5 weeks of age, FCR was significantly (P<0.05) improved in birds received diet containing 1.0 ml CO/kg diet compared with birds fed 0.5 g antibiotic/kg diet but not significantly differed when compared with control and other dietary treatment groups. It is worth to not that FCR in chicks fed diet supplemented with different levels of GO or CO and its mixture was insignificantly better compared with control group.

**Table 3. Feed intake and feed conversion ratio ( $\overline{X}$ ±SE) for growing Japanese quails as affected by dietary ginger and cinnamon oil supplementations**

| Item | Feed intake (g/bird/day) | | | Feed conversion ratio (g feed/g gain) | | |
|---|---|---|---|---|---|---|
| | 1-3 weeks | 3 -5 weeks | 1-5 weeks | 1-3 weeks | 3 -5 weeks | 1-5 weeks |
| **Control** | 20.26 ± 1.02 | 25.32 ± 0.46 | 22.79 ± 0.74 | 4.32 ± 0.21 | $3.70^{ab}$ ± 0.13 | $4.01^{ab}$ ± 0.15 |
| **Antibiotic (0.5g/kg diet)** | 20.33 ± 0.84 | 25.31 ± 0.12 | 22.82 ± 0.48 | 4.41 ± 0.16 | $3.91^{a}$ ± 0.08 | $4.16^{a}$ ± 0.11 |
| **0.5 ml GO/ kg** | 20.14 ± 0.64 | 24.43 ± 0.41 | 22.28 ± 0.12 | 4.29 ± 0.07 | $3.40^{b}$ ± 0.13 | $3.85^{ab}$ ± 0.08 |
| **1.0 ml GO/ kg** | 21.08 ± 1.33 | 24.92 ± 0.80 | 23.00 ± 1.07 | 4.33 ± 0.32 | $3.43^{b}$ ± 0.06 | $3.88^{ab}$ ± 0.16 |
| **0.5 ml CO/ kg** | 20.65 ± 0.34 | 24.64 ± 0.64 | 22.64 ± 0.44 | 4.33 ± 0.15 | $3.47^{b}$ ± 0.02 | $3.89^{ab}$ ± 0.08 |
| **1.0 ml CO/ kg** | 19.06 ± 1.28 | 24.47 ± 0.62 | 21.76 ± 0.94 | 3.89 ± 0.32 | $3.43^{b}$ ± 0.10 | $3.66^{b}$ ± 0.12 |
| **0.25 ml GO+ 0.25 ml CO/kg** | 21.04 ± 0.77 | 24.89 ± 0.28 | 22.97 ± 0.41 | 4.23 ± 0.18 | $3.58^{b}$ ± 0.15 | $3.90^{ab}$ ± 0.15 |
| **0.50 ml GO+ 0.50 ml CO/kg** | 20.87 ± 0.65 | 24.25 ± 0.50 | 22.55 ± 0.36 | 4.27 ± 0.08 | $3.63^{ab}$ ± 0.04 | $3.95^{ab}$ ± 0.05 |
| **F. test** | NS | NS | NS | NS | * | * |

- GO: ginger oil; CO: cinnamon oil.
- Means in the same column within each classification bearing different letters are significantly different. *= significant (P<0.05) and NS = Not significant.

It could be noticed that the better FCR value was recorded in chicks fed diet supplemented with 1.0 ml CO/kg diet, while the poorest FCR value was recorded in chicks fed 0.5 g antibiotic/kg. The improvement in FCR due to addition of GO or CO and its mixture could be attributed to their effects on nutrient digestibility which reflected on improvement of daily body weight gain and feed conversion (**Ocak *et al.*, 2008; Isabel and Santos, 2009**). Our results agree with **Lee *et al.* (2003)** who used carvacol from oregano and **Alcicek *et al.* (2004)** who used 48mg /kg of an essential oil mixture in the diet of broiler. **Jamroz *et al.* (2005)** showed that FCR was improved by 4.2% when used cinnamaldehyde in chicks diet. **Cabuk *et al.* (2006)** stated that addition of 48 ppm/kg essential oils mixture significantly improved FCR of broilers. The positive effect of dietary cinnamon oil on gain and feed conversion ratio could be related to increased efficiency of feed utilization and/or altered carcass composition (**Ciftci *et al.*, 2009**). Similarly, studies reported that essential oils blocked effect of pathogens in the digestive system (**Guler *et al.*, 2005**).

Contradicting results, **Botsoglou *et al.* (2004)** and **Hernandez *et al.* (2004)** demonstrated that addition of plant extract or essential oils to the diets of broiler had no beneficial effect on their feed conversion ratio. **Rahimi *et al.* (2011)** reported that chicks fed diet supplemented with 15 ppm virginiamycin had better FCR than those fed diet supplemented with 0.1% aqueous extract of garlic.

## Carcass Traits

Effect of dietary supplementation with antibiotic and essential oils on some carcass traits at the end of the experimental period is presented in Table 4. It was observed that percent of carcass, dressing and gizzard were significantly (P<0.05) affected by dietary treatments. On the other hand, percent of giblets, heart and liver were not significantly affected; carcass, dressing and gizzard were not significantly differed between tested groups compared with control. However, the group received diet containing 0.5 ml GO+0.5 ml CO/kg had significantly (P<0.05) higher carcass and dressing percentages when compared with group received diet containing 0.5ml CO /kg (Table 4).

Our findings are in agreement with the results of **Hernandez *et al.* (2004)** who found no significant differences in carcass traits of broiler chicks fed diet contain essential oil extract from oregano, cinnamon, pepper, thyme and rosemary). Similar results were obtained by **Jamroz *et al.* (2005)** and **Cabuk *et al.* (2006)** who used different essential oils in broiler diets

**Table 4. Carcass traits ($\overline{X}$ ±SE) for growing Japanese quails as affected by dietary ginger and cinnamon oils supplementation**

| Item | Carcass traits (% of pre-slaughter weight) | | | | | |
|---|---|---|---|---|---|---|
| | Carcass | Dressing | Giblets | Liver | Heart | Gizzard |
| **Control** | 70.35 ± 0.20$^{ab}$ | 76.59 ± 0.53$^{ab}$ | 6.24 ± 0.36 | 2.79 ± 0.27 | 0.87 ± 0.04 | 2.58 ± 0.16$^{ab}$ |
| **Antibiotic (0.5g/kg diet)** | 69.02 ± 2.47$^{ab}$ | 74.93 ± 1.89$^{ab}$ | 5.90 ± 0.63 | 2.89 ± 0.60 | 0.88 ± 0.08 | 2.14 ± 0.11$^{b}$ |
| **0.5 ml GO/ kg** | 69.62 ± 2.66$^{ab}$ | 75.79 ± 2.84$^{ab}$ | 6.17 ± 0.19 | 3.04 ± 0.04 | 0.88 ± 0.05 | 2.24 ± 0.17$^{b}$ |
| **1.0 ml GO/ kg** | 72.79 ± 0.30$^{ab}$ | 78.33 ± 0.69$^{ab}$ | 5.55 ± 0.48 | 2.40 ± 0.46 | 0.85 ± 0.06 | 2.30 ± 0.12$^{ab}$ |
| **0.5 ml CO/ kg** | 67.75 ± 1.92$^{b}$ | 73.90 ± 1.55$^{b}$ | 6.16 ± 0.59 | 2.70 ± 0.40 | 0.91 ± 0.03 | 2.54 ± 0.34$^{ab}$ |
| **1.0 ml CO/ kg** | 72.24 ± 0.54$^{ab}$ | 78.34 ± 0.46$^{ab}$ | 6.10 ± 0.28 | 2.97 ± 0.22 | 0.84 ± 0.10 | 2.29 ± 0.09$^{ab}$ |
| **0.25 ml GO+0.25 ml CO/kg** | 70.93 ± 1.12$^{ab}$ | 77.50 ± 0.95$^{ab}$ | 6.57 ± 0.29 | 3.03 ± 0.35 | 0.78 ± 0.05 | 2.77 ± 0.10$^{a}$ |
| **0.50 ml GO+0.50 ml CO/kg** | 73.46 ± 1.75$^{a}$ | 79.50 ± 1.98$^{a}$ | 6.04 ± 0.34 | 2.83 ± 0.12 | 0.78 ± 0.05 | 2.43 ± 0.20$^{ab}$ |
| **F. test** | * | * | NS | NS | NS | * |

- GO: ginger oil; CO: cinnamon oil.

- Means in the same column within each classification bearing different letters are significantly different. *= significant (P<0.05) and NS = Not significant.

based on maize and locally cereals. **Symeon *et al.* (2014)** found insignificant differences in the percentages of liver, heart and gizzard have been found in broilers after the dietary supplementation with cinnamon oil.

In contrast, **Alcicek *et al.* (2004)** and **Zhang *et al.* (2005)** demonstrated that, broiler chicks which fed essential oils combination extracted from herbs showed significantly higher carcass weight compared with those fed basal diet. **Dieumou *et al.* (2009)** found that liver percentage of broilers decreased (p<0.05) in garlic oil treatment as compared with chicks fed ginger oil and control. Also, **Ramadan (2013)** found that percentages of heart, gizzard and spleen were not significantly affected by essential oil supplementation in the diet.

It could be concluded that GO and CO could act as a good alternative to antibiotics in growing Japanese quail diets.

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## تأثيـــر إضـــافـــة زيت الزنجبيـــــل والقـــرفـــة علـــى أداء الســـمان اليـابـانـى النـامى

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أجريت هذه التجربة لدراسة تأثير إضافة المضاد الحيوى والزيوت الأساسية فى العليقة على أداء النمو (وزن جسم الطائر حى، وزن الجسم اليومى، الغذاء المستهلك ومعامل التحويل الغذائى) وصفات الذبيحة للسمان اليابانى النامى، تم تقسيم ٣٦٠ طائر سمان يابانى عمر أسبوع عشوائياً إلى ٨ معاملات وكل معاملة قسمت الى ٣ مكررات (١٥ طائر لكل مكررة)، كان لكتاكيت مجموعات التجربة نفس متوسط الوزن المبدئى تقريبا، تم تغذية المجموعة الاولى على عليقة بدون اى اضافات (عليقة الكنترول)، المجموعة الثانية تم تغذيتها على عليقة مضاف لها مضاد حيوى ٠.٥٠ جم/كجم عليقة، المجموعة الثالثة والرابعة تم تغذيتها على عليقة مضاف لها ٠.٥٠ مل و ١.٠ مل زيت الزنجبيل/كجم عليقة، المجموعة الخامسة والسادسة تم تغذيتها على عليقة مضاف لها ٠.٥٠ مل و ١.٠ مل زيت القرفة/كجم عليقة، المجموعة السابعة والثامنة تم تغذيتها على عليقة مضاف لها ٠.٥٠ مل و ١.٠ مل / كجم عليقة خليط من زيت الزنجبيل وزيت القرفة (١:١)، بالترتيب، وبينت النتائج ان كتاكيت السمان المغذاه على ٠.٢٥ مل زيت الزنجبيل و ٠.٢٥ مل زيت القرفة/كجم عليقة سجلت أعلى زيادة فى وزن جسم الطائر الحى بالمقارنة بالمجموعة المغذاة على عليقه بها ٠.٥ جم مضاد حيوى/كجم عليقة، كما أظهرت النتائج وجود زيادة ملحوظة فى وزن الجسم اليومى للطائر فى المجموعة المغذاة على عليقة تحتوى على مستويات مختلفة من زيت الزنجبيل أوزيت القرفة و ٠.٢٥ مل زيت الزنجبيل و ٠.٢٥ مل زيت القرفة/كجم عليقة بالمقارنة بالمجموعة المغذاة على ٠.٥ جم مضاد حيوى /كجم عليقة، كما لم يسجل اختلافات كبيرة فى استهلاك الغذاء بين المعاملات خلال فترة التجربة (عمر ١-٣ ، ٣-٥ و١-٥ اسابيع)، وتم تقدير افضل معامل تحويل للغذاء فى المجموعة المغذاة على عليقة تحتوى على ١.٠ مل زيت القرفة/كجم عليقة، بينما تم تقدير اقل معامل لتحويل الغذاء فى المجموعة المغذاة على ٠.٥ جم مضاد حيوى/كجم عليقة، بالإضافة الى نسبة كلا من الذبيحة صافى بدون تربيش، الذبيحة بالريش والقانصة تأثرت بمعاملات العليقة بشكل ملحوظ، ويمكن الاستنتاج ان زيت الزنجبيل وزيت القرفة تعتبر بدائل جيده للمضادات الحيوية فى علائق السمان اليابانى النامى

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