**Impact of antioxidant and lipid lowering effect of Epigallocatechin gallate on growth and lipid profile of two broiler strains.**

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**ABSTRACT**

This study aimed to evaluate the impact of lipid lowering and powerful antioxidant effect of Epigallocatechin gallate (EGCG) supplementation on growth performance, serum and meat lipid profile and antioxidant enzymes in two different broiler strains. A total of 360 one day old chicks, 180 Sasso T44 and 180 ISA Hubbard were randomly divided into two equal groups one considered control and the second supplemented with EGCG 95% at rate of 450 mg/kg ration each group was subdivided into 6 replicates each of 15 chicks. The obtained results revealed that EGCG supplementation had significantly reduced body weight at 42 day age (1582.41 vs. 1503.94 g) and 63 day old (2796.08 vs. 2604.19 g) and similarly within each breed treated groups of Sasso t44 and ISA Hubbard showed significantly lower weights at 42 and 63 days age however, ISA Hubbard showed more reduction in final body weight. Total weight gain reduced by EGCG supplementation. Feed intake had significantly reduced by treatment (6592.05 vs. 6061.78 g) and subsequently, feed conversion had improved by treatment (2.47 vs. 2.8). EGCG supplementation had significantly reduced mortality % (2.24 vs. 3.31 %). Serum total lipids, triacylglycerol and cholesterol and meat triacylglycerol and cholesterol had significantly reduced by EGCG supplementation. EGCG supplementation had significantly improved antioxidant enzymes as MDA significantly reduced in treated groups, while GPx and SOD were significantly increased. In conclusion, EGCG could be used as hypolipidemic feed additive and as a potent antioxidant improve general health status and to improve FCR and reduce mortality rate.

**Key words: Epigallocatechin gallate, broilers, growth performance, lipid profile, antioxidant enzymes.**

**INTRODUCTION.**

The extraordinarily increased growth rate of broilers which resulted from many trials for improvement by several methods of genetic selection for high growth rate over the past several decades had improved growth rate and FCR however, it resulted in many side effects. One of the main side effects of excessive growth rate is massive fat accumulation in body cavities and meat. Excessive fat accumulation in chickens is one of the problems facing chicken meat industry and it is not important for physiological body functions and it considered as a heavy load on the antioxidant system as majority of them are unsaturated fat, which is susceptible to oxidation (**[Ahmadipour](https://bmcvetres.biomedcentral.com/articles/10.1186/s12917-018-1561-6%22%20%5Cl%20%22auth-1) et al., 2018)**.

To poultry farmers, excess fat is an economic burden due to its negative impact on feed efficiency, and most fat depots are lost during processing of the carcass and meat. Too much fat deposition is also undesirable to consumers who are increasingly concerned with the nutritional quality of food. For these reasons, many studies have recently focused on the lipid‐lowering effects of natural compounds added to chicken feed (**Huang et al., 2015**)

Another major side effect of rapid growth rate and high feed intake is the production of increased level of free radicals. Free radicals are defined as atoms, molecules, or ions that have unpaired valence electrons and the increased production of free radicals able to cause damage to all biological macromolecules such as DNA, proteins, and lipids, and this would result in cell damage and as a result will end with manifestation of pathological conditions. We could refer to oxidative stress as an imbalance between the free radicals production in the body and the ability of the living organism to detoxify them or to overcome their harmful effects through neutralization by antioxidants. Oxidative stress considered one of the most common predisposing causes for diseased conditions (**[Aliki](https://www.hindawi.com/19423896/) et al., 2017**).

As a result for the increased need for production of more healthy chicken meat and developing lower cost and powerful antioxidants which able to reduce free radicals and other harmful metabolites effect on fast growing broilers and also, synthetic antioxidants are reported to have many side effects, and therefore, natural antioxidants are preferred. Green tea powder contains quaternary polyphenolic compounds such as catechin, epicatechin, epigallocatechin, gallocatechin, and epigallocatechin gallate. Catechins and their derivatives are biologically reactive in the presence of dissolved oxygen. EGCG is the most potent antioxidant among all green tea catechins. EGCG acts as a scavenger for many reactive oxygen/nitrogen species such as superoxide radical anions, peroxyl and hydroxyl radicals, singlet oxygen, nitric oxide, and peroxynitrite (**Aydogan et al., 2018**).

Also, lipid lowering of EGCG in broilers had reported by many researches however the anti-obesity mechanism of green tea and EGCG still unknown. Thus, in this study to evaluate the lipid lowering and antioxidant effect of EGCG as a natural extract; serum lipid profile, meat lipids and the activity of some antioxidant enzymes and the effect of EGCG on growth performance, feed intake, FCR and mortality rate were examined in this study.

**MATERIALS AND METHODS.**

1. **Birds, management and experimental design:**

All procedures were implanted according to the Local Experimental Animal Care Committee and approved by the ethics of the institutional committee of Damanhur University, Egypt. The experiment was carried out in a research unit in which 360 one day old chicks of two breeds (Sasso T44 and ISA Hubbard) each of 180 chicks were randomly allotted into two groups each of 90 chicks one considered control and the second group was supplemented with EGCG 95% at rate of 450 mg/kg ration, each group was subdivided into 6 replicates each of 15 chicks. Broiler chicks were reared on wire cages each replicate in one pen, the pen diameters were 1 meter length, 90 cm width and 45 cm height. All cages were equipped with feeding hoppers made of galvanized steel and automatic drinkers (nipples with cup). Birds were brooded on 33 oC, 30 oC and 27oC during first, second and third week, respectively and 24 oC from 4th till 9th week of age. Birds were subjected to the recommended vaccination program. Sasso chicks were obtained from El Wafa Co., Shopra El Namla, El Gharbia, Egypt, while ISA Hubbard (Red Hubbard as locally known) were obtained from Mna El Amir for poultry, El Maryotia, Sakara desert road, Abo Seer, Giza, Egypt. Control groups were fed on basal diet for the first four weeks on El Fagr starter ration and fed on EL Fagr grower ration for remaining period of the experiment (manufactured by El Fagr company for feed industry, Al Nubarya, El Bohira, Egypt), while treated groups fed on the same ration supplemented with EGCG 95% (Manufactured by Xi’an Wanfun Biotech Co. LTD, Shaanxi, China) at rate of 450 mg/kg.

**Table 1: Basal diet composition and chemical analysis:**

|  |  |  |
| --- | --- | --- |
| Ingredients  | Starter diet % | Grower diet % |
| Yellow corn  | 53.65 | 58.15 |
| Soybean meal (44%) | 32.6 | 29.5 |
| Corn gluten (60%) | 8.0 | 6.5 |
| Vegetable oil1 | 2.0 | 2.0 |
| DCP2 | 1.7 | 1.5 |
| Limestone3 | 1.3 | 1.6 |
| Lysine4 | 0.05 | 0.05 |
| DL-Methionine5 | 0.15 | 0.15 |
| Salt | 0.3 | 0.3 |
| Premix (vitamin)6 | 0.15 | 0.15 |
| Mineral premix7 | 0.1 | 0.1 |
| **Chemical analysis:** |
| Moisture Crude protein Ether extractCrude fibre Ash NFE\* Calcium Total phosphorus Methionine\* Lysine\* ME Kcal/kg diet\*\* Calorie/protein ratio\*\*\* | 12.1422.854.682.796.7950.751.100.730.671.233039.8133.03 | 12.9821.125.252.656.5551.451.090.680.561.193058.7144.82 |

1Vegetable oil (mixture of sunflower oil and cottonseed oil). 2DCP= dicalcium phosphate (contain 18% P and 25% Ca). 3Limestone (contain 34% calcium). 4Lysine = lysine hydrochloride (contain 98.5% Lysine). 5DL-Methionine (Produced by Evonic Co and contain 99.5% methionine). 6The premix used was Heromix produced by Heropharm and composed of (per 1.5 kg) vitamin A 12000000 IU, vitamin D3 2500000 IU, vitamin E 10000 mg, vitamin K3 2000 mg, thiamin 1000 mg, riboflavin 5000 mg, pyridoxine 1500 mg, cyanocobalamin 10 mg, niacin 30000 mg, biotin 50 mg, folic acid 1000 mg, pantothenic acid. 7 mineral premix: formulated and composed of (each 1 kg) 70000 mg Mn, 60000mg Zn (Using zinc oxide (ZnO) and replaced by zinc polysaccharide complex or nano zinc particles), 8000mg Cu, 1000mg I, 250mg Se and 150mg Co.

\* NFE= Nitrogen free extract (calculated by difference "100- (moisture% + CP% + EE % + CF% + ash%)". \*\*Calculated according to (12) as follows: Metabolizable energy MJ/Kg = 1.549+ (CP%\*0.102) + (EE %\*0.275) + (NFE%\*0.148) + (CF%\*0.034). The results multiply by 0.239 X 1000 = Kcal/kg. \*\*\*Calorie/protein ratio = ME Kcal/CP%.

1. **Data collection and measurements:**

Birds were individually weighted at day old and each 3 weeks separately at early morning before receiving any feed or water. Daily feed consumption per bird was recorded. Residues and wasted feed were weighed daily and then subtracted from the offered amounts to obtain the actual accumulated feed consumed, and then feed conversion ratio (FCR) was calculated. Daily water intake/ bird were calculated. Final body weight was at 63 day old, total weight gain were calculated as the difference between the 63 day body weight and one day body weight, total feed intake was the sum of feed consumed during all the experiment, total feed conversion was calculated.

At slaughtering, blood samples were collected from 5 birds randomly as a sample selected from each replicate, sample tubes were left in a slope position till serum samples were separated through centrifugation at 3000 rpm for 15 minutes. The sera were collected and preserved in a deep freezer at (-20oC) until the time of analysis*.* Serum Total lipids: It was determined by Total lipids kit of Bio-diagnostic (**Zollner and Kirsch, 1962)**. Serum Triacylglycerol was determined by Triacylglycerol kit of Bio-diagnostic according to the method of **Fossati and Prencipe, (1982)**. Serum cholesterol determined according to the method of **Allian et al., (1974)**. Glutathione peroxidase activity GPx measured using the (**Paglia and Valentine 1967)** spectrophotometry method based on the Northwest Life Science Specialties (NWLSS™) Glutathione peroxidase assay kits protocol NWK-GPX01. Malondialdehyde (MDA) concentration was measured by the method of (**Jo and Ahn, 1998)**. Super Oxide Dismutase (SOD) activity was assessed using the NWLSS™ Superoxide dismutase activity assay, which provided a simple, rate method for determining SOD activity. This method is based on monitoring the auto-oxidation rate of haematoxylin as originally described by (**Martin Jr., et al., 1987)**. Meat triacylglycerol and cholesterol content eatimated in breast meat samples which collected, stored, prepared and extracted according to **Folch et. al. (1957)**.Estimation of meat triacylglycerol was determined by triglyceride kit of Bio-diagnostic according to **Fossati and Principe (1982).** Estimationof meat cholesterol content was determined by cholesterol kit of Bio-diagnostic according to **Richmond (1973) and Allain et al. (1974)**.

1. **Statistical Analysis:**

All replicates showed no significant differences within each group in all studied parameters therefore, the current data were normally distributed and were subjected to statistical analysis using Proc GLM by SAS program (**SAS Institute, SAS® 2009**) with the following model:

Xijkl = μ + Ai + Bj + (AB) ij +eijkl

Where:

Xijkl = an observational data.

μ = Overall mean.

Ai = Effect of ith breed of broilers i=1and 2 (1= Sasso T44 and 2=ISA Hubbard).

Bj = Effect of jth EGCG supplementation j=1 and 2 (1= Control and 2=EGCG treated).

(AB)ij = Effect due to interaction between breed and EGCG supplementation.

eijkl = random error.

**RESULTS.**

1. **Body weight:**

Results of body weight ay day old, 21 days old, 42 days old and 63 day old were presented in Table 2. The two broiler breeds showed no significant differences in all presented body weights. EGCG supplementation had significantly (P≤0.05) reduced body weight at 42 day (1582.41 vs. 1503.94 g) and 63 day old (2796.08 vs. 2604.19 g). Regarding the effect interaction between breed and EGCG supplementation, EGCG had reduced body weight in Sasso T44 and ISA Hubbard at similar range in treated groups than control groups at 42 day (1511.43 and 1496.45 vs. 1561.09 and 1603.73 g, respectively) and 63 day (2618.76 and 2589.59 vs. 2772.66 and 2819.51 g, respectively).

**Table 2: Effect of breed, EGCG supplementation and their interaction on body weight.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Items** | **Day old weight** | **21 day weight** | **42 day weight** | **63 day weight** |
| **Effect of Breed.** |
| **Sasso T44.** | 36.03±0.91 | 784.00±8.63 | 1536.26±13.08 | 2695.71±12.07 |
| **ISA Hubbard.** | 37.23±1.01 | 793.33±9.12 | 1550.09±14.00 | 2704.55±13.11 |
| **Effect of treatment.** |
| **Control.** | 36.72±0.99 | 794.38±9.03 | 1582.41±13.44a | 2796.08±12.64a |
| **EGCG** | 36.55±1.01 | 782.95±9.01 | 1503.94±13.79b | 2604.19±12.85b |
| **Effect of interaction.** |
| **Sasso T44.** | **Control.** | 36.01±0.85 | 790.02±8.05 | 1561.09±14.00b | 2772.66±13.01b |
| **EGCG** | 36.04±0.97 | 777.98±9.15 | 1511.43±12.62c | 2618.76±11.92c |
| **ISA Hubbard.** | **Control.** | 37.43±0.99 | 798.75±9.07 | 1603.73±13.88a | 2819.51±13.51a |
| **EGCG** | 37.03±1.03 | 787.91±9.21 | 1496.45±14.23c | 2589.59±12.79c |

Means ± standard error carry different superscripts within the same column are significantly different (P≤0.05).

1. **Total weight gain, total feed intake, FCR and mortality %:**

Data presented in table 3 had showed that Sasso T44 and ISA Hubbard breeds showed no significant differences in Total weight gain, total feed intake, FCR and mortality %. EGCG supplementation had significantly (P≤0.05) reduced total weight gain (2567.64 vs. 2759.36 g) however EGCG supplementation in treated groups showed significantly (P≤0.01) lower feed intake (6061.78 vs. 6592 g) and significantly (P≤0.05) lower FCR (2.28 vs. 2.47) and similarly mortality % (2.24 vs. 3.31 %). The effect of interaction between breed and EGCG supplementation showed the same trend as total weight gain significantly reduced in treated groups of Sasso T44 and ISA Hubbard than control groups (2582.72 and 2552.56 vs. 2736.65 and 2782.08 g, respectively) while total feed intake results showed slightly different findings as EGCG supplemented group in ISA Hubbard breed showed significantly lower feed intake than Supplemented group in Sasso T44 and both showed significantly lower feed intake than control groups (6002.74 vs. 6220.82 vs, 6550.38 and 6533.72 g, respectively). FCR findings revealed significant improvement in both treated groups of Sasso T44 and ISA Hubbard than control groups (2.31 and 2.25 vs. 2.49 and 2.45) and similarly mortality % (2.21 and 2.27 vs. 3.25 and 3.37 %, respectively).

**Table 3: Effect of breed, EGCG supplementation and their interaction on body weight gain, feed intake, feed conversion ratio and mortality rate.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Items** | **Total weight gain** | **Total feed intake** | **Total FCR** | **Mortality %** |
| **Effect of Breed.** |
| **Sasso T44.** | 2659.69±12.05 | 6385.60±33.64 | 2.40±0.09 | 2.73±0.08 |
| **ISA Hubbard.** | 2667.33±12.99 | 6268.23±35.72 | 2.35±0.09 | 2.82±0.09 |
| **Effect of treatment.** |
| **Control.** | 2759.36±12.77a | 6592.05±34.66a | 2.47±0.07a | 3.31±0.10a |
| **EGCG** | 2567.64±13.00b | 6061.78±34.81b | 2.28±0.10b | 2.24±0.08b |
| **Effect of interaction.** |
| **Sasso T44.** | **Control.** | 2736.65±13.03a | 6550.38±36.03a | 2.49±0.09a | 3.25±0.10a |
| **EGCG** | 2582.72±11.87b | 6220.82±34.17b | 2.31±0.09b | 2.21±0.07b |
| **ISA Hubbard.** | **Control.** | 2782.08±13.49a | 6533.72±35.22a | 2.45±0.10a | 3.37±0.09a |
| **EGCG** | 2552.56±12.69b | 6002.74±33.91c | 2.25±0.08b | 2.27±0.09b |

Means ± standard error carry different superscripts within the same column are significantly different (P≤0.05).

1. **Serum and meat lipid profile:**

Result of serum total lipids, serum triacylglycerol, serum cholesterol, breast meat triacylglycerol and breast meat cholesterol presented in table 4 revealed that Sasso T44 and ISA Hubbard breeds had no significant differences in all estimates. EGCG supplementation had significantly (P≤0.01) reduced serum total lipids (526.19 vs. 594.55 mg/dl), serum triacylglycerol (155.21 vs. 169.75 mg/dl), serum cholesterol (172.57 vs. 180.75 mg/dl), meat triacylglycerol (129.21 vs. 152.03 mg/dl) and meat cholesterol (138.07 vs. 160.00 mg/dl). In the same way, results of interaction between breed and EGCG supplementation showed that ISA Hubbard EGCG supplemented group had significantly lower serum total lipids than Sasso T44 EGCG supplemented group and both were significantly lower than control groups in serum total lipids (519.41 vs. 532.97 vs. 592.07 and 597.03 mg/dl, respectively). Serum triacylglycerol was significantly (P≤0.01) reduced in EGCG supplemented groups than control groups of both breeds (155.77 and 154.65 vs. 169.73 and 168.71 mg/dl, respectively), while serum cholesterol results was slightly different as, EGCG supplementation had significantly reduced serum cholesterol in ISA Hubbard breed however, Sasso T44 Breed showed no significant affection. Meat triacylglycerol was significantly (P≤0.01) reduced in EGCG supplemented group of both breeds (129.87 and 128.55 vs. 152.13 and 151.93 mg/dl, respectively). Similarly, meat cholesterol was significantly (P≤0.01) reduced by EGCG supplementation in both breeds (137.43 and 138.71 vs. 160.79 and 169.21 mg/dl, respectively).

**Table 4: Effect of breed, EGCG supplementation and their interaction on serum and meat lipid profile.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Items** | **Serum total lipids** | **Serum triacylglycerol** | **Serum cholesterol** | **Meat triacylglycerol** | **Meat cholesterol** |
| **Effect of Breed.** |
| **Sasso T44.** | 562.52±9.77 | 162.75±4.77 | 178.21±5.93 | 141.00±3.77 | 149.11±4.32 |
| **ISA Hubbard.** | 558.22±8.15 | 161.68±4.53 | 175.11±5.81 | 140.24±4.26 | 148.96±4.51 |
| **Effect of treatment.** |
| **Control.** | 594.55±10.03a | 169.22±5.01a | 180.75±5.78a | 152.03±4.17a | 160.00±4.44a |
| **EGCG** | 526.19±8.00b | 155.21±4.18b | 172.57±6.00b | 129.21±3.88b | 138.07±4.49b |
| **Effect of interaction.** |
| **Sasso T44.** | **Control.** | 592.07±9.86a | 169.73±5.02a | 181.57±6.00a | 152.13±4.04a | 160.79±4.40a |
| **EGCG** | 532.97±8.04b | 155.77±4.47b | 174.85±5.87ab | 129.87±3.51b | 137.43±4.28b |
| **ISA Hubbard.** | **Control.** | 597.03±10.11a | 168.71±5.00a | 179.93±5.69a | 151.93±4.28a | 159.21±4.49a |
| **EGCG** | 519.41±7.97c | 154.65±3.97b | 170.29±6.17b | 128.55±4.23b | 138.71±4.51b |

Means ± standard error carry different superscripts within the same column are significantly different (P≤0.01).

1. **Oxidative stress parameters:**

Oxidative stress parameters data presented in table 5 showed that the two breeds showed no significant difference in oxidative stress parameters. MDA had significantly (P≤0.05) reduced by EGCG supplementation (2.13 vs. 2.62 nmoles/ml) while, GPx activity had increased by EGCG supplementation (25.43 vs. 21.36 U/gHb) and similarly SOD activity (65.17 vs. 53.39 U/gHb). Results of interaction between breed and EGCG supplementation showed similar findings as, MDA reduced significantly (P≤0.05) by EGCG supplementation in both breeds (1.99 and 2.27 vs. 2.63 and 2.61 nmoles/ml, respectively) and GPx activity increased in EGCG supplemented groups (25.50 and 25.36 vs. 22.26 and 20.46 U/gHb, respectively) and similarly SOD activity (64.14 and 55.20 vs. 54.11 and 52.68 U/gHb, respectively).

**Table 5: Effect of breed, EGCG supplementation and their interaction on oxidative stress parameters.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Items** | **MDA** | **GPx** | **SOD** |
| **Effect of Breed.** |  |  |  |
| **Sasso T44.** | 2.31±0.08 | 23.88±1.17 | 59.12±1.93 |
| **ISA Hubbard.** | 2.44±0.10 | 22.91±1.21 | 59.44±2.04 |
| **Effect of treatment.** |  |  |  |
| **Control.** | 2.62±0.09a | 21.36±1.15b | 53.39±1.92b |
| **EGCG** | 2.13±0.09b | 25.43±1.23a | 65.17±2.06a |
| **Effect of interaction.** |  |  |  |
| **Sasso T44.** | **Control.** | 2.63±0.09a | 22.26±1.16b | 54.11±1.98b |
| **EGCG** | 1.99±0.07c | 25.50±1.18a | 64.14±1.89a |
| **ISA Hubbard.** | **Control.** | 2.61±0.09a | 20.46±1.17b | 52.68±1.85b |
| **EGCG** | 2.27±0.11b | 25.36±1.25a | 66.20±2.23a |

Means ± standard error carry different superscripts within the same column are significantly different (P≤0.05).

**DISSCUSSION.**

The high growth rate and intern the increased feed intake to compensate that growth rate would result in increased unhealthy fat content of chicken meat, reduce feed efficiency as abdominal fat discarded from carcass and increase the oxidative stress on broilers as a result of free radicals production. Oxidative stress may be the etiological factor for several diseases in farm animals and poultry (**Ahmadipour et al., 2018**).

The current study aimed to assess the effect of EGCG supplementation on lowering serum lipid profile and meat lipids content and improvement of antioxidant activity and its impact on growth performance, feed intake, FCR and mortality rate in two broiler breeds widely used for rearing in Egypt and reared for longer periods compared to other breeds and known with their high fat content; Sasso T44 and ISA Hubbard. The obtained results showed that the two breeds had no significant differences in all parameters under study. Supplementation of broilers with ration contains EGCG 95% at level 450 mg/kg of ration had reduced body weight at 42 day and final body weight at 63 days age and similarly total weight gain, while feed consumption had significantly reduced and FCR had greatly improved. Similarly, mortality rate had significantly improved by EGCG supplementation.

Lipid lowering effect of EGCG was reported as its supplementation had resulted in reduction of serum total lipids, serum triacylglycerol and cholesterol and also, meat triacylglycerol and cholesterol had significantly reduced by treatment. In the same way, oxidative stress parameters had improved by EGCG supplementation as, MDA reduced and GPx and SOD activity increased in treated groups. The two breeds showed nearly similar results in treated groups with no difference in response to EGCG supplementation. The lipid lowering effect of EGCG could be attributed to its ability to increase lipid catabolism and the improvement of oxidative stress parameters were due to the potent antioxidant activity of natural green tea extract specially EGCG.

In accordance, the findings obtained by **Huang et al. (2015)** were similar to this study results as they studied the effects of Epigallocatechin gallate on lipid metabolism and its underlying molecular mechanism in broiler chickens and they reported that serum triglycerides and low-density lipoprotein cholesterol of chickens in EGCG group were also significantly decreased compared with the control group and they suggested that EGCG could alleviate fat deposition in broilers through inhibiting fat anabolism and stimulating lipid catabolism in broilers.

**Xue et al. (2017)** were studied the effect of epigallocatechin gallate on growth performanceand antioxidant capacity in heat-stressed broilers and they reported similar findings in the effect of EGCG in improvement of antioxidant system activity however, they reported that EGCG had desirable effect on growth performance but that may be due to they studied its effect in heat stressed birds. In a similar study **Jingxian et al. (2018)** had reported a linear increase in activities of GSH-Px, SOD and CAT at 35 d of age, and linear decreased in MDA contents and they concluded that EGCG can improve the growth performance of broilers by enhancing antioxidant property and alleviating oxidant damage caused by heat stress.

The results obtained by **Aydogan et al. (2018)** which carried their study to evaluate the effects of Supplemental Epigallocatechin Gallate in the Diet of Broilers Exposed to Fluoride Intoxication and they stated EGCG has potent antioxidant and regenerative effects that can ameliorate the detrimental effects of fluoride toxicity on blood parameters and the liver.

In conclusion, supplementation of broilers with EGCG 95% at level of 450 mg/kg ration had desirable effect on improvement of meat lipid content by reducing serum and meat lipid profiles and also, EGCG had potent antioxidant activity ant it improved studied oxidative stress parameters by reducing MDA and increasing antioxidant enzymes activity however, EGCG supplementation under normal condition had reduced final body weight and weight gain but with improvement of feed efficiency and FCR.

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