PS9.03 Effect of green tea (Camellia sinensis) and mixed probiotics on meat oxidation, fatty acids profile and cholesterol in broilers 182.00

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***Abstract*- An experiment was conducted with green tea and mixed probiotics to know their effect on meat oxidation, fatty acids profile and cholesterol in broilers. One hundred sixty eight day old chicks were considered to six dietary feed additives groups with four repetitions. The treatments were: control, antibiotics (basal+30 ppm oxytetracycline), green tea (basal+0.5% and 1.0%) and green tea mixed probiotics, GTMP (basal+0.5% and 1.0%). The TBA content of broiler meat in 0.5% green tea group showed lowest value in comparison with other groups and it reduced significantly ($p<0.05$) from control at slaughter date to 7 days. A significantly lowest level of meat cholesterol content was observed in 1.0% GTMP, which is similar with 0.5% green tea groups ($p < 0.5$). The fatty acids profile in meat especially omega 6 to omega 3 fatty acids ratio showed a very desirable level in 0.5% green tea and 1.0% GTMP compared to other treatments. Based on the findings it may be concluded lower level of green tea (0.5%) and higher levels of GTMP (1.0%) can be replicable to antibiotic for broilers meat quality.**

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Key words: Fatty acids profile; Green tea; Green tea mixed probiotics; Meat TBA value

I. INTRODUCTION

Chicken meat enriched with PUFA, which increases the susceptibility of meat to oxidation. It also enhance the development of organoleptic problems and lead to an increased susceptibility to lipid oxidation [1]. Oxidative damage occurs in the living animal due to an imbalance between the production of reactive oxygen or nitrogen species and the defense mechanism of the animal against oxidative stress. Lipid oxidation causes loss of nutritional and sensory values as well as the formation of potentially toxic compounds that compromise meat quality and reduce its shelf life. In practice, meat is stored and cooked for consumption. Although proteins are the major compounds of most biological systems, little research has been performed on protein oxidation. Protein oxidation also reduced meat product quality [2] It's suggested that the ratio of n-6 to n-3 fatty acids in the human diet should be around 10:1 to 5:1 but in the USA and Europe this ratio is too high 25:1 to 50:1 followed by Japan, 12:1 [3]. Eating too much omega-6 and too little omega-3 causes clots and constricts arteries to increase risk for heart attacks, diabetes, obesity, cancer etc. Many researches point out the possibility to modify in poultry meat contents of fatty acids and improve the PUFA ω 6/PUFA ω 3 ratio in the lipids of breasts and thighs. Cholesterol is a fatty substance in the blood and too much of it can block arteries. So lowering cholesterol level is also a great concern for the researchers' by dietary change and medication. Outbreaks of resistant bacteria and residues of antibiotics in poultry products, uses of antibiotics are restricted internationally Several studies have been performed investigating the effect of dietary administration of natural antioxidants on the oxidative stability of meat or meat products. Green tea having catechin, a potential natural antioxidant, inclusion in broiler diets had positive effects on growth and lean meat production [4]. Probiotics, with medicinal plants, is being suggested as an effective antibiotics alternative. It is reported that supplementation of 0.1 and 0.2% of mixed probiotics containing *Lactobacillus acidophilus, Bacillus subtilis* and *Saccharomyces cervisae* improves production of broilers [5].. The objective of this study was to investigate the effects of green tea and its fermented probiotics on meat quality of broilers in respect of meat oxidation, fatty acids profile, and cholesterol.

I. MATERIALS AND METHODS

A. Animals and experimental design

A total of 168 "Ross" broiler day old chicks were housed in wire cage following CRD design. The birds were assigned to six dietary treatments, control, antibiotic (basal+30 ppm oxytetracycline), green tea (basal+0.5% and 1.0%) and GTMP (basal+0.5% and

1.0%). The feed and drinking water were provided *ad libittum.*

B. Experimental diets and feeding

Diets were starter (0-3 weeks) and finisher (4-5 weeks) and formulated as suggested by NRC, 1998. Nutrient contents were ME 3,100 kcal/kg and CP 22% for starter and ME 3,150 kcal/kg and CP 19% for finisher. This GTMP was made by mixing green tea powder, defatted rice bran, wheat bran and fermenting the mixture with beneficial bacteria. Lactic acid bacteria (*Lactobacillus acidophilus* and *Lactobacillus plantarum*) were formulated into media containing 10% green tea, 60% defatted rice bran and 30% wheat bran. It was, then, fermented at 40°C for 5 hours in anaerobic conditions and 3 hours in aerobic conditions and it was subsequently continued for 48 hours. After that, there was a second inoculation with bacteria (*Bacillus subtilis*) and yeast (*Saccharomyces cerevisiae*), then dried. This is composed of 19.20% of crude protein, 2.92 % crude fat, 11.08% of crude fiber in the GTMP.

C. TBA Analysis

For determination carcass rancidity for broiler meat the method described by Vernon *et al.* (1970) was used with small modifications. The TBA value was measured and expressed as µmol melondialdehyde/100 g meat.

D. Fatty acids profile and Cholesterol

At the end of the experiment, 24 chickens were slaughtered and samples were collected from breast and thai muscle. The fatty acids profile and cholesterol content of meat were determined by using Gas Chromatograph (GC), DS 6200. Fatty acids were identified by matching their retention times with those of their relative standards, as well as by following the book of Food Composition Table (RDA, Korea, 1996). Meat cholesterol also determined by GC following the methods of Brunnekreeft et al., 1983.

E. Statistical analysis

The data obtained from this study were analyzed by general linear models (GLM) of SAS Package Program (1990) to estimate variance components for a completely randomized design. Duncan's multiple comparison tests were used to examine significant differences between treatment means. Differences were statistically assessed at $p<0.05$.

II. RESULTS AND DISCUSSION

In figure 1, TBA value of fresh broiler meat was significantly lower in 0.5% GTMP group (1.69 µmol/100g), compared to control (2.31 µmol/100g) ($p<0.05$). After one week of storage, TBA value of broiler meat was significantly higher in control compared to 0.5% green tea and GTMP treatments ($p<0.05$). In figure 2, the average pattern of TBA value after 3 weeks of storage are shown. Yang et al. (2003) reported that the TBA value of broiler meat was decreased significantly with 0.5% to 2.0% green tea by-products supplement diet[6]. Mountney (1976) reported that the rancidity of broiler meat arises faster than the red meat of porks and beefs because of more unsaturated fatty acid contained [7]. It can be conclude that the green tea supplementation in broiler diet may reduce the rancidity of the broiler meat.

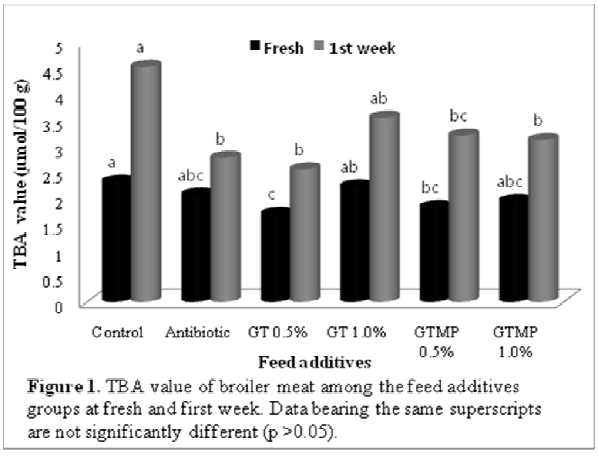

Figure 1. TBA value of broiler meat among the feed additives groups at fresh and first week. Data bearing the same superscripts are not significantly different ($p>0.05$).

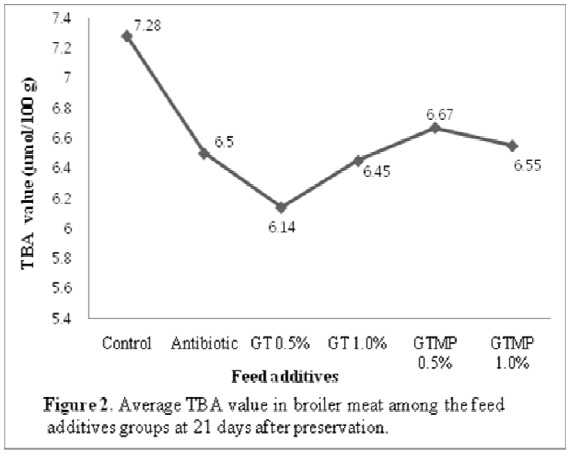

Figure 2. Average TBA value in broiler meat among the feed additives groups at 21 days after preservation.

In table 1, shows the fatty acids content in breast and thigh muscle. It was observed the amount omega 3 fatty acids didn't show significant difference among the treatments except DHA (C22:6ω3). DHA in 1.0% FGTP showed significant highest value compared to other feed additives groups. DHA has been identified as an essential building block of brain, nerve and eye tissues. EPA reduces inflammation and blood clots within the cardiovascular system. It was observed the overall value of omega 6 and omega 3 fatty acids in mixed thigh and breast meat was 6.31:1 which is agreed with Comprada et al., 2001. Their study showed this ratio was 10.40:1 though lower ratio in chicken meat 4.77 was recorded.1 In developed countries, there is a noticeable imbalance of PUFA ω 6/PUFA ω 3 ratio in human nutrition, mostly because of insufficient fish consumption and lack of cereals rich in omega-6 fatty acids in animal feeding regimes, which negatively affects composition of animal products [8].

Table 1. Effects of feeding green tea and fermented green tea probiotics diets on the fatty acid profile (g/100g of total fatty acids) in broiler meat

Fatty acids	Control	Antibiotics	Green tea		FGTP	
			0.5%	1.0%	0.5%	1.0%
SFA	32.14	32.12	31.92	32.39	31.72	31.33
MUFA	45.82	45.81	46.48	46.43	46.6	46.87
C18:2ω6	18.16^{a}	17.84^{ab}	17.19^{b}	18.06^{ab}	17.75^{ab}	17.45^{ab}
C20:2ω6	0.33^{c}	0.34^{bc}	0.43^{a}	0.46^{bc}	0.40^{ab}	0.37^{abc}
C20:4ω6	0.61^{c}	0.82^{a}	0.84^{a}	0.81^{a}	0.71^{b}	0.82^{a}
C18:3ω3	0.76^{b}	0.71^{bc}	0.81^{a}	0.72^{bc}	0.75^{abc}	0.67^{c}
C20:5ω3	0.35^{b}	0.41^{a}	0.42^{a}	0.31^{b}	0.34^{b}	0.40^{a}
C22:5ω3	0.42^{c}	0.47^{abc}	0.51^{a}	0.49^{a}	0.44^{bc}	0.50^{a}
C22:6ω3	1.41^{c}	1.48^{b}	1.44^{bc}	1.33^{cd}	1.29^{d}	1.59^{a}
PUFA	22.04	22.07	21.64	22.18	21.68	21.8
USFA	67.86	67.88	68.08	68.61	68.28	68.67
ω 6	19.1	19	18.46	19.33	18.86	18.64
ω 3	2.94^{b}	3.07^{a}	3.18^{a}	2.85^{b}	2.82^{b}	3.16^{a}
MUFA/SFA	1.43	1.43	1.45	1.48	1.47	1.50

[a,b,c] Mean with different superscripts within the same rows are significantly different (P<0.05)

C18:2ω6 (linoleic acid), C20:2ω6 (Eicosadienoic acid), C20:4 ω6 (arachidonic acid), C18:3ω3 (α-linoleic acid), C20:5ω3 (eicosapentoenoic acid), C22:5ω3 (Docosapentaenoic acid), C22:6ω3 (Docosahexanoic acid)

Significantly lowest meat cholesterol was observed in 1.0% GTMP (figure 3), which is similar with 0.5% green tea groups ($p < 0.5$) and agrees with other observation [9]. Our study showed that the trends of omega 6 to omega 3 fatty acids were lower in 0.5% green tea and 1.0% GTMP compared to other treatments (Figure 4).

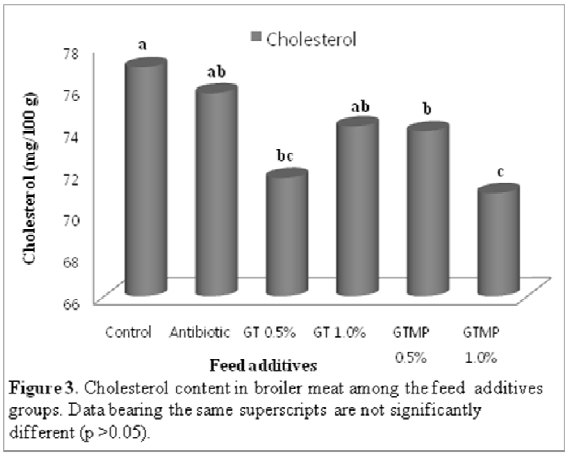

Figure 3. Cholesterol content in broiler meat among the feed additives groups. Data bearing the same superscripts are not significantly different ($p > 0.05$).

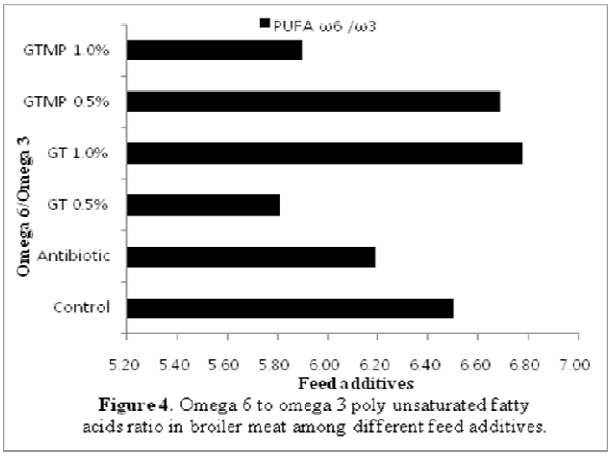

Figure 4. Omega 6 to omega 3 poly unsaturated fatty acids ratio in broiler meat among different feed additives.

Although the values are higher but it has positive effects which aggress with another study their ratio of omega 6 and omega 3 fatty acids should be as close as possible 1:1[10].

III. CONCLUSION

Based on the findings it may be concluded lower level of green tea (0.5%) and higher levels of GTMP (1.0%) can be replicable to antibiotic for broilers meat quality.

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