EFFECT OF MEDICINAL PLANTS AND PROBIOTICS ON THIOBARBITURIC ACID VALUE IN BROILER CHICKEN MEAT

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Abstract - Three experiments were conducted with six medicinal plants and mixed probiotics to know their effect on lipid oxidation property in broiler meat. Day old broiler chicks were considered for these studies with different medicinal plants & probiotics combination. After 35 days the broilers were slaughtered & tested the thiobarbituric acid (TBA) value in day 1 & Day 21 after keeping -20ºC. In every case it was observed that addition of plants with probiotics fed birds show lower thiobarbituric acid (TBA) value representing reduced oxidation due to antioxidative property. It could be concluded that herbal plants and probiotic can protect meat oxidation due to their active components.

Key Words – Medicinal plants. Probiotics, Thiobarbituric acid, Broiler chicken, Meat

I. INTRODUCTION

The thiobarbituric acid (TBA) test is the most widely used method for quantifying lipid oxidation development in meat and meat products. The TBA test determines the amount of malondialdehyde (MDA), a major secondary byproduct of lipid oxidation, in an oxidized lipid. Lipid oxidation leads to free radical production through the destruction of cellular membrane, proteins and nucleic acids and eventually cell death. Probiotics with medicinal plants are being suggested as effective antibiotics alternatives as well as antioxidative property in broiler [1-2]. It is reported that supplementation of 0.1 and 0.2% of mixed probiotics containing *Lactobacillus acidophilus, Bacillus subtilis* and *Saccharomyces cerevisiae* improve production of broilers and indirect immunity [3]. Addition of mixed probiotics with medicinal plants (green tea) can reduce the rancidity i.e. oxidation of broiler meat after preservation up to 3 weeks [4] observed that 1.0% *Salicornia herbacea* probiotics can be replaceable to antibiotic for broiler production. 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 [5]. The objective of these studies was to investigate the effects of medicinal plants and probiotics on meat quality of broilers in respect of meat oxidation for fresh meat and preserved frozen meat

II. MATERIALS AND METHODS

Day old chicks of broiler were used for conducting these experiments up to 35 days. 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. Dietary addition of plants having active components with probiotics is shown in Table 1 & 2.

DETERMINATION OF LIPID OXIDATION

For the determination of lipid oxidation (carcass rancidity) of broiler breast and thigh meat the method was followed as described by Vernon et al. [6] with little modifications. For this analysis, thigh and breast meat were blended separately for 1.5 min in a chilled stainless watering blender cup. Then 4 g of meat samples were taken in a wide test tubes and 10 ml of extracting solution containing 20% trichloroacetic acid (TCA) in 2M phosphoric acid was added. 10 ml of double distilled water (DDW) was added to sample test tube and then homogenized by a vertical homogenizer. The homogenized sample solution was then filtered by 110 mm filter paper.

Table 1. Medicinal plants active compounds for the improvement and maintenance of health and productivity

Sl. No.	English Names (Botanical Names)	Active Compounds	Role/Functions	References
1.	Green tea (*Camellia sinensis*)	Catechins (Polyphenol), has 4 types EC, EGC, ECG and EGCG.	Antioxidant, Anti-carcinogenic, Increases energy metab., fatty acid oxidation, apidogenesis)	Weisburger et al., 2001 Mukhtar & Ahmed, 1999
2.	Glasswort (*Salicornia herbacia*)	Tungtungmadic acid	Antioxidant	Rhee et al., 2009 Kim et al., 2009
3.	Houttuynia (*Houttuynia cordata*)	Chlorogenic acid	Antimicrobial, Immunomodulatory Antioxidant	Meng et al., 2009 Chen et al., 2003
4.	Water plantain (*Alisma canaliculatum*)	β-sitosterol, Choline	Elevated HDL level-reduces atherosclerosis	Jung et al., 1994 ADA, 2002
5.	Sea Tangle (*Laminaria japonica*)	Fucoxanthin (Carotinoid)	Antioxidant Combat cancer	Sachindra et al., 2007 Das et al., 2008
6.	Cornelian Cherry (*Cornus officinalis*)	Ursolic acid	Antioxidant Antibacterial (Plant) Antifungal (Fruit)	Nawa et al., 2007 Duke & Ayensu, 1985, Brown, 1995

Source: Sarker (2010). PhD Thesis, Sunchon National University. Jeonnam, South Korea.

Table 2. Number of microflora population and their population used in the additives

Item	Content
Number of Micro flora in GTMP[b]	
Lactobacillus acidophilus KCTC[c] 3111	4.2×10^7 cfu/g
Lactobacillus plantarum KCTC 3104	5.8×10^6 cfu/g
Bacillus subtilis KCTC 3239	2.6×10^7 cfu/g
Saccharomyces cerevisiae KCTC 7915	6.2×10^9 cfu/g

KCTC: Korean Collection for Type Culture

III. RESULTS AND DISCUSSION

There were three studies conducted with medicinal plants and probiotics as dietary feed additives for assessing their antioxidative property in the broiler meat. These short findings are summarized and discussed shortly.

Study 1: Dietary green tea (*Camellia sinensis*) and probiotics in lipid oxidation of meat

Sarker et al. (2009) showed a reducing trend in lipid oxidation when fed broilers medicinal plant (green tea) with the same probiotics and same level (Fig 1 & 2). Uuganbayar (2004) reported that 0.5 to 1.5% green tea supplement in broiler diet had effects to reduce the TBA value on broiler meat compared to the control and Yang et al. (2003) also reported that the TBA value of broiler meat was decreased significantly when broilers were fed diets with 0.5% to 2.0% green tea by-products supplement diet. The rancidity of broiler meat arises faster than the red meat of pork and beefs because of more unsaturated fatty acid contained [7].

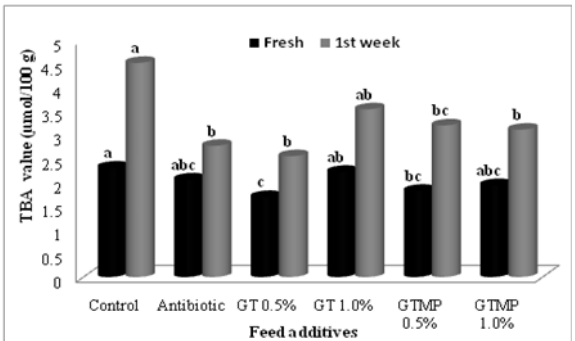

Fig. 1. Effect of feed additives on TBA value of broiler meat at fresh and first week. Data with same superscripts are not significantly different ($p>0.05$).

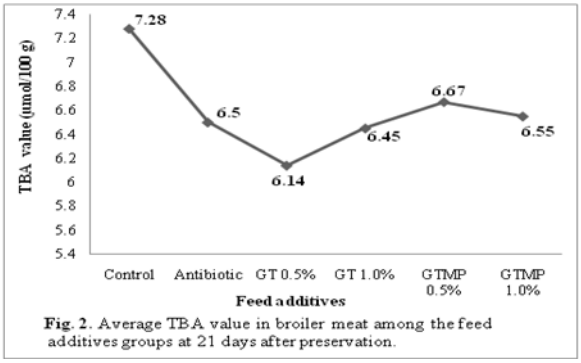

Fig. 2. Average TBA value in broiler meat among the feed additives groups at 21 days after preservation.

The TBA value of broiler meat was decreased significantly when broilers were fed diets with 0.5% to 2.0% green tea by-products supplement diet [8]. Red meat and poultry are usually susceptible to lipid oxidation due to high fat content. There are limited studies that focused on the use of tea catechins, natural antioxidants, to prolong the shelf life of different meat types by inhibiting lipid oxidation [9]. Tang et al., 2001 stated that addition of tea catechins at a level of 300mg/kg was shown to inhibit lipid oxidation significantly in red meat and poultry.

Study 2: *Alisma canaliculatum, Laminaria japonica and Cornus officinalis,* treated with Probiotics in lipid oxidation of broiler meat

In this study three different plants were treated with probiotics and after slaughtering of the birds the meat were tested by lipid oxidation. Here (Fig 3), breast meat showed always lower TBA value than thigh meat. Betti et al. (2009) also stated that the melon dialdehyde (MDA) values were greater in thigh meat compared to breast meat probably because greater amount of fat content in the thigh meat. The antioxidative property of plants helps in reducing free radical production in animal body.

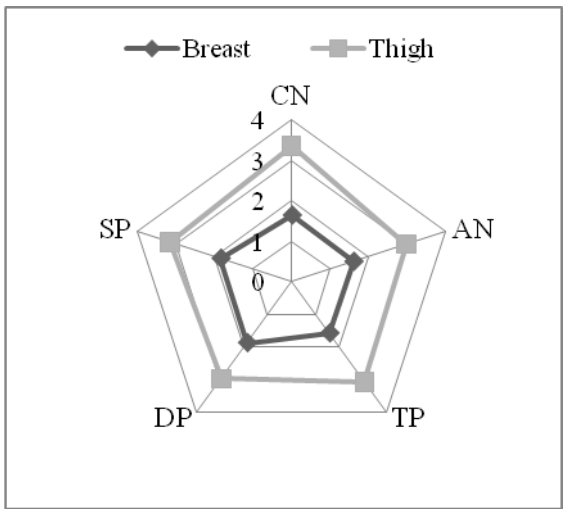

Fig. 3. Effect of adding probiotics with medicinal plants on the TBA values in breast and thigh meat of broilers (CN-Control, AN-Antibiotic, TP-Theksa Probiotics, DP-Dashima Probiotics, SP-Sansuyu Probiotics).

Study 3: *Salicornia Herberbacea* and *Houttuynia Cordata* with probiotics in lipid oxidation of broiler meat

In table 3, the TBA values of fresh broiler meat and preserved (4°C in cold chamber) were significantly lower in all the additives group compared to control ($P<0.05$). The average TBA value of 0 to 3 weeks of storage at 4ºC, in broiler meat in all feed additives group showed the lowest value than control (Fig. 4). 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.

Table 3. Effect of hamcho and eosungcho probiotics on thiobarbituric acid value in the broiler meat (µmol MDA[1]/100g)

Storage time (Week)	Control	Antibiotic	Hamcho and Eosungcho Probiotics		
			0.5%	1.0%	2.0%
Fresh	1.74 [a]	1.44 [b]	1.33 [b]	1.29 [b]	1.29 [b]
1st	6.07 [a]	4.06 [b]	3.51 [b]	3.14 [b]	4.66 [ab]
2nd	15.19 [a]	10.40 [b]	7.41 [b]	8.19 [b]	5.98 [b]
3rd	20.09 [a]	10.38 [b]	11.09 [b]	8.47 [b]	12.52 [ab]

[a, b, c]Means with different superscripts within same raw are significantly different ($p<0.05$). [1]MDA = Melondialdehyde

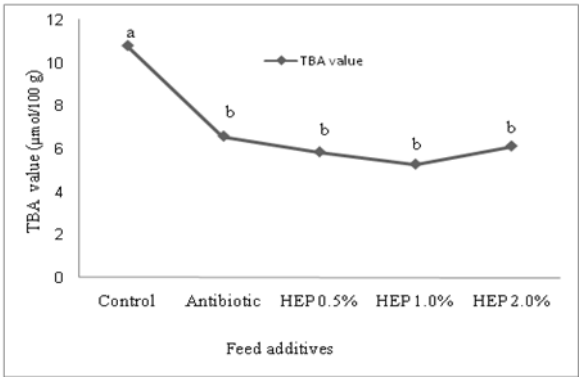

Fig. 4. Effect of Hamcho Eosungcho Probiotics on thiobarbituric acid (TBA) value in broiler meat

IV. CONCLUSION

It may be concluded that herbal plants and probiotic can protect meat oxidation due to their active components. Further research is needed in this area to draw a definite conclusion.

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REFERENCES

[1] Sarker, M.S.K., Park, S.R., Kim, G.M. & Yang, C.J. (2010). Hamcho (*Salicornia herbacea*) with probiotics as alternative to antibiotic for broiler Production. Journal of Medicinal Plants Research, 4(5): 415-420.

[2] Sarker, M.S.K., Kim, G.M., Hossain, M.E., Sharmin, M.F., Huque, K.S. & Yang, C.J. (2011). Effect of Mixed Probiotics Treated with *Alisma canaliculatum*, *Laminaria japonica* and *Cornus officinalis* on Oxidation, Cholesterol and Fatty Acids Profile in Broiler Meat. 9th Asia Pacific Poultry Conference. Taipei International Convention Center, Taipei, Taiwan. 20-23 March.

[3] Kim, H.S., Yu, D.J., Park, S.Y., Lee, S.J., Choi, C.S., Seong, C.K. & Ry
U, K.S. (2002). Effects of single and mixed feeding of *Lactobacillus* and yeast on performance, nutrient digestibility, intestinal microflora, fecal NH_3 gas emission in laying hens. Korean Journal f Poultry Science, 29(3): 225-231

[4] Kaneko, K., Yamasaki, K., Tagawa, Y., Tokunaga, M., Tobisa M. & Furuse M. (2001). Effects of dietary Japanese green tea powder on growth, meat ingredient and lipid accumulation in broilers. Journal of Poultry Science. 38 (5), 77-85.

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