THE EFFECTS OF GREEN TEA AND THYME EXTRACT INJECTION ON THE QUALITY OF CHICKEN MEAT

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Abstract- The aim of this study was to determine the effects of green tea and thyme extracts on the quality of chicken meat. Green tea and thyme extract injected groups and the control groups were stored at 4°C. Physical, chemical, sensorial and textural analyses were carried out on the 1st, 4th, 7th, 10th and 15th days of storage period. TBA values increased significantly with storage time and the highest TBA values were recorded for the control group. Microbiological analyses did not reveal any antimicrobial effects of green tea and thyme extracts.

Key Words - Aromatic plants, Marination, Meat

• INTRODUCTION

Usage of new feed additives has become widespread with the developing poultry industry. Feed additives used unconsciously have damages on human and/or animal health. Therefore, researchers have pointed out the usage of aromatic plants and extracts as an alternative to feed additives and have studied the effects of these plants on animals [1].

One of the methods used for preserving and improving the quality attributes is the injection system. This system improves overall meat quality. Marination liquids injected to meat also improves the quality attributes of meat.
The injectors can consist of a single needle operated manually or multiple needles automatically controlled to deliver a precise volume of liquid [2]. In the meat industry, multiple needles are generally used in order to obtain uniform finished products and eliminate the disadvantages of other methods [1].

Therefore, the aim of this study was to determine the effects of green tea and thyme extracts on the quality of chicken meat by injection method.

• MATERIALS AND METHODS

Sampling procedure
Breast meats weighing approximately 200-250 g weight were immediately removed from each carcass slaughtered under commercial conditions. All samples were packed in polystyrene trays, covered with stretch film and stored at +4°C after injecting 10%, 300 ppm green tea and thyme extract solutions. Groups were named as KTE (control; no injection), KE (thyme extract solution injected) and YE (green tea extract injected). Analyses were carried on the 1st, 4th, 7th, 10th and 15th days of storage. Duplicate samples and three replications were measured from each group.

Methods

Proximate Analyses
Proximate analyses of samples (total moisture, total protein, total fat and ash) were carried out

by using AOAC (1990) method [3].

pH determination
10 g sample was homogenized with 100 mL distilled water. A pH-meter (WTW Inolab pH 730) electrode was immersed to solution and the pH value of sample was determined [3].

Determination of lipid oxidation
The extent of lipid oxidation was determined by the TBA (2-thiobarbituric acid) assay using the distillation method of Tarladgis et al. [4].

Colour measurement
Colour measurement was determined by using the method of Kayaardi and Gök [5].

Texture Analysis: Warner-Bratzler Shear Force (WBSF)
Green tea extract injected, thyme extract injected and control samples were boiled for 60 minutes and then cooled to room temperature and cut in rectangular shape (1x1x5). Samples were sheared using Warner-Bratzler Shear (WBS) V-shaped blade. The WBS cell was attached to TA-XT Plus Texture Analyzer (Stable Micro Systems, England). A croos-head speed of 100 mm min^{-1} was applied using a 50 kg load cell. Mean values for samples (n=6) were expressed in terms of firmness (kg) and toughness (kgsec).

Sensory Analysis
Samples were cooked in cooking bags in a water bath for approximately 60 minutes to reach an internal temperature of 72 °C. Samples were cut into 1x1x5 mm slices as in WBSF analysis. 10 panelists rated the samples for appearance, texture, juiciness, flavor and overall liking by a scale-of-five. Panelists were given a glass of water to cleanse the palate between samples.

Microbiological analyses
Total aerobic mesophilic bacteria count (TAMB), *Staphylococcus aureus* count, and *Salmonella* determination and *Escherichia coli* count were carried out by using APHA (1976) methods [6].

Statistical analysis
All data were subjected to analysis of variance (ANOVA). The statistical significance of the differences between means was determined by the method of Duncan's test and computerized using SPSS [7]. Statistical significance for all comparisons was made at $P<0.05$.

- RESULTS AND DISCUSSION

%Moisture

Moisture content of green tea and thyme extract injected samples during 15-day storage were found between 74,52-77,86%. The maximum moisture content was found for thyme extract injected samples on the 7th day of storage; the minimum moisture content was determined for control group on the 7th day of the storage. On the first day of storage, moisture content of all samples were significantly different ($P<0.05$), but on the 15th day of storage, while there was no difference between moisture content of green tea extract injected and thyme extract injected samples ($P>0.05$), moisture content of control group was significantly different than other groups ($P<0.05$).

Samples injected with extracts had higher moisture values than noninjected control. The

increased water content of meat might be the result of the use of aqueous solutions of green tea and thyme extracts for injection. Similarly, Cunningham et al. [8] found that the moisture content of marinated turkey meats were higher than control samples. In addition, Ergezer [9] determined that chicken breast meats marinated with different marinades had higher moisture content than control groups.

Total ash, total fat and total protein content

Ash content of green tea and thyme extract injected samples during 15-day storage ranged from 1.19 to 1.30%. Ash contents of green tea and thyme extract injected groups were lower than those of control.

Total fat content of green tea and thyme extract injected samples during 15-day storage were between 0.65 and 1.72%. The maximum fat content was found for green tea extract injected samples and the minimum fat content was for thyme extract injected samples which was different from other groups ($P<0.05$).
Total protein content of green tea and thyme extract injected samples during 15-day storage were between 18.07 and 22.61%. Storage period had no effect on total protein content ($P>0.05$).

pH

Green tea and thyme extracts injected samples had pH values ranging from 6.18 to 6.92. Thyme extract injected samples had the highest pH value on the 15th day of storage period and control samples had lowest pH value on the 7th day of storage. Storage time significantly affected ($P <0.05$) pH value of samples.

TBA values

The TBA values of samples increased with storage time (Fig 1). Control samples had highest TBA values and were followed by thyme extract injected samples. Storage time significantly affected ($P<0.05$) TBA value of samples.

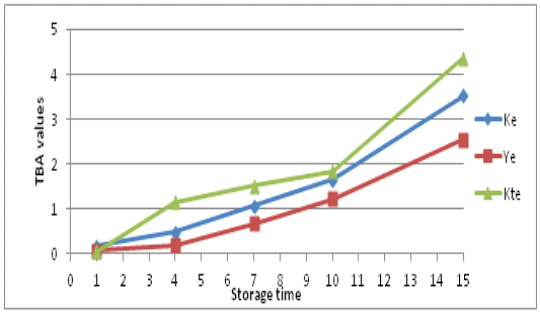

Figure 1. TBA value (mg malonaldehyde/kg) changes of samples during storage period. KTE:control (no injection), KE(thyme extract solution injected) and YE (green tea extract injected).

Green tea extract injected samples had lowest TBA values during storage period. In previous studies, it was also concluded that green tea addition to meat samples reduced lipid oxidation [10-12].

Colour

L* values of samples during 15-day storage were in the range of 60.51-66. The maximum L* values were found for thyme extract injected samples on the 1st day of storage; the minimum

L* value were determined for control group on the 4th day of the storage. Storage time had a significant effect on L* values of samples ($P<0.05$).

L* value of injected samples were found higher than control groups. And so, injection was thought to increase lightness of samples. a* values of samples during 15-day storage were in the range of 6.3-11.3. Thyme extract injected samples had the highest a* value on the 10th day of storage period and the same sample group also had the lowest a* value on the last day of storage period. Storage time had a significant effect on a* values of samples ($P<0.05$). The maximum b* values were found for thyme extract injected samples on the 15th day of storage; the minimum b* value were determined for control group on the 4th day of the storage. Storage time had no effect on b* values of samples ($P>0.05$).

Cooking Loss

Green tea injected samples had the highest; and control group had the lowest cooking loss values indicating that injection increased the cooking loss. This is because injection application damages the connective tissue and decreases water holding capacity of meat so water loss during cooking increases.

Texture Analysis: Warner-Bratzler Shear Force

When shear forces of green tea and thyme extract injected samples were examined, maximum shear force values were determined for thyme extract injected samples as 5.83 kg and minimum shear force values were determined for control group as 5.5 kg and this indicates that most tender group is control group. Injection had no effect on firmness ($P>0.05$).

Water losses of samples during cooking are thought to be the reason of high firmness values. Similar results were reported by Karaca [13] who studied chicken breast meats obtained from broilers fed vitamin and minerals supplemented diet.

Sensory Properties

The injection of green tea and thyme extracts had no significant ($P>0.05$) effect on texture, and appearence but had a significant ($P<0.05$) effect on juiciness, flavour and overall liking.

Control group had the highest appearence scores so it was concluded that different additives had no effect on the appearence of chicken meats. Control group samples also had highest texture scores and this scores was supported by shear force results that tenderness of control samples were found higher than other groups. Green tea and thyme extract injected samples had lower juiciness scores than control group. This was thought to be because of high cooking loss values. Maximum flavour scores were determined for control group as 4.40 and minimum flavour scores were determined for green tea extract injected samples as 3.40. Differences between thyme extract injected and green tea extract injected groups were not significant but control group had significantly higher flavour scores ($P<0.05$). Maximum overall liking scores were determined for control group and minimum overall liking scores were determined for thyme extract injected samples. Differences between thyme extract injected and green tea extract injected groups were not significant but control group had significantly higher flavour scores ($P<0.05$). As a result, panelists differentiated injected samples according to their flavour and juiciness attributes and reflected this difference as overall liking score. It was concluded that injection application had no effect on consumption quality.

Microbiological Analyses

As a result of microbiological analyses *Salmonella* and *Staphylococcus aureus* were not determined. Storage time and green tea and thyme extract injection had a significant effect on the TAMB and E.coli values of samples as shown in Table 2 and 3 ($P<0.05$).

Table 2 TAMB values of samples during storage period

	1st day	4th day	7th day	10th day	15th day
KTE	3,74± 0,26^{Ac}	3,73± 0,20^{Bc}	4,67± 0,11^{Cb}	4,87± 0,07^{Bb}	6,16± 0,51^{Aa}
YE	4,65± 0,33^{Ad}	5,73± 0,27^{Ac}	6,00± 0,04^{Bbc}	6,28± 0,15^{Aab}	6,64± 0,61^{Aa}
KE	4,74± 0,97^{Ac}	5,40± 0,14^{Abc}	6,69± 0,23^{Aa}	5,85± 0,62^{Aab}	5,99± 0,69^{Aab}

KTE: control (no injection), KE(thyme extract solution injected) and YE (green tea extract injected).a, b, c: different letters within a same line differ significantly during storage period ($P < 0.05$). A, B, C: different letters within a same column differ significantly between samples($P < 0.05$). Results are expressed as mean±SD.

Table 3 E.coli values of samples during storage period

	1st day	4th day	7th day	10th day	15th day
KTE	3,10± 0,34^{Bab}	3,31± 0,28^{Aab}	3,74± 0,85^{Aa}	2,55± 0,64^{Bbc}	2,01± 0,43^{Cc}
YE	3,06± 0,26^{Bb}	3,59± 0,28^{Aab}	3,80± 0,81^{Aa}	3,44± 0,16^{Aab}	3,61± 0,11^{Aab}
KE	3,92± 0,39^{Aa}	3,70± 0,169^{Aab}	4,21± 0,63^{Aa}	3,24± 0,26^{Ab}	3,04± 0,49^{Bb}

KTE: control (no injection), KE(thyme extract solution injected) and YE (green tea extract injected).a, b, c: different letters within a same line differ significantly during storage period ($P < 0.05$). A, B, C: different letters within a same column differ significantly between samples($P < 0.05$). Results are expressed as mean±SD.

However green tea and thyme extracts were known to have strong microbial effects, it could not be determined by microbiological analyses.

- CONCLUSION

In this study, the injection of green tea and thyme extracts in chicken breast meats improved the oxidative stability. Acidic structure of green tea and thyme extracts and microbiological and chemical deteriorations during storage effected pH significantly. There was no effect of green tea and thyme extracts on the appearence of samples.

In conclusion, with this study, the effect of green tea and thyme extracts on the quality characteristics of chicken meat was aimed to be determined and the results summarized above. Our country is rich in terms of these aromatic plants and so there is a need for further studies. If the quality characteristics expected by consumers are obtained, either cost will decrease or novel manufacturing and consuming alternatives will be provided. As a result, it is suggested that meat consumption could increase and so public health could be effected positively.

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