

Quality Characteristics of Irradiated Turkey Breast Rolls Formulated with Plum Extract

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Summary and Implications

The effects of adding 1%, 2% and 3% plum extract on the quality characteristics of vacuum-packaged, irradiated RTE turkey breast rolls were determined. Turkey breast rolls were sliced, packaged and irradiated at 0 or 3 kGy using a Linear Accelerator. Lipid oxidation, volatile profiles, color, texture, proximate analysis and sensory characteristics of sliced turkey breast rolls were determined at 0 and 7 days of storage. Addition of plum extract had no detectable effect on the proximate analysis of turkey breast rolls. Plum extract increased a^* and b^* -values, and decreased L^* value of turkey breast rolls due to the original color of plum extract. Addition of >2% plum extract to turkey breast rolls was effective in controlling lipid oxidation of irradiated meat and the production of aldehydes (hexanal, heptanal, octanal, and nonanal) in nonirradiated meat at Day 0. Texture of turkey breast rolls was not influenced, but juiciness was increased by plum extract. Therefore, addition of 3% or higher of plum extract is recommended to improve mouth-feel and antioxidant effect in irradiated turkey breast rolls. However, the color of turkey breast rolls with 3% plum extract was dark and might not be appealing to consumers.

Introduction

Ready-to-eat (RTE) cooked meat products such as turkey breast rolls and turkey hams have been the subject of large product recalls and multistate outbreaks linked to *Listeria monocytogenes*. A 10-year microbial prevalence study clearly showed the seriousness of food safety problem in RTE meat products, especially for sliced ham. Considering a series of recent outbreaks and product recalls due to pathogenic bacteria in meat, the expanded application of irradiation technology in meat products becomes especially important.

Irradiation is an effective way to eliminate pathogens, including *L. monocytogenes*, *Salmonella*, *Yersinia enterocolitica*, and others, but its application to meat is limited partially because irradiation produces a characteristic aroma, and changes color, flavor and taste of meat that significantly impact upon consumer acceptance. Therefore, enhanced quality characteristics of irradiated RTE turkey breast roll are critical to increase its acceptability to consumers.

Ready-to-eat turkey breast roll generally has a “dry” mouth-feel due to its relatively low fat content (1 to 2% fat). Plum extract contains sorbitol, a known humectant, which naturally binds moisture and thus has the potential to alleviate the “dry” mouth-feel in low fat contents meat. The addition of plum extract to ground beef resulted in the production of hamburgers with a mouth-feel and texture that closely simulated the presence of fat in the cooked meat. More importantly, plum extract contains antioxidants; therefore, it can reduce the development of off-odors from lipid oxidation in this meat product during irradiation.

The objective this study was to determine the effect of plum extract on quality characteristics of vacuum-packaged, irradiated RTE turkey breast rolls. Lipid oxidation, sensory characteristics, volatiles, color, texture and proximate analysis of RTE turkey breast rolls formulated with plum extract during storage were evaluated.

Materials and methods

Sample preparation

Four plum concentrations were prepared, which included basic formula without plum extract (control), and with 1%, 2% and 3% plum extract. The basic formula for turkey breast rolls was 90% meat, 6.5% ice water, 1.25% sodium chloride, 1% transglutaminase, 0.5% sodium caseinate, 0.5% dextrose, and 0.25% sodium tripolyphosphate. Four batches of each plum treatments were prepared.

Each plum extracts treatment and the basic meat ingredients were mixed with ground turkey breast for 3 min using a 3-mm plate and stuffed into large cellulose casings (10.5 cm in diameter), which were clipped and stored overnight at 4 °C to facilitate cross-link formation by transglutaminase. The next morning, the rolls were heat-processed in a oven to an internal temperature of 75 °C, immediately chilled with a cold water shower for 10 min, and stored at 4 °C for 4 h. The cooked, chilled rolls were sliced (2.0-cm-thick slices for texture measurement and 1.0-cm-thick slices for other quality analyses) and vacuum-packaged. The vacuum-packaged breast slices from each additive treatment were randomly divided into 2 groups and irradiated at 0 or 3 kGy using Linear Accelerator (Surebeam; Chicago, IL, USA). Color, volatiles, texture and TBARS were analyzed at 0 and 7 day, and sensory characteristics were determined after 5 days of storage.

Statistical analysis

Data were processed by the General Linear Model (GLM) of Statistical Analysis System. The differences in the mean values were compared by the SNK (Student-Newman-Keuls) multiple range test, and mean values and standard error of the means (SEM) were reported ($P < 0.05$).

Results and Discussion

Chemical analyses

All composition, especially moisture and lipid contents, of RTE turkey breast rolls with plum extract-added was similar to that of control. The TBARS values of irradiated samples immediately after irradiation were lower than those of nonirradiated samples. After 7 d of storage at 4 °C, irradiated samples did not develop lipid oxidation because turkey breast meat had low lipid contents and all samples were vacuum-packaged. Plum extract significantly reduced the TBARS of irradiated turkey breast rolls at Day 7.

Irradiation increased the amounts of hydrocarbons and sulfur compounds, which are known to cause irradiation off-odor in turkey breast rolls. The amounts of hydrocarbons also increased during storage. Plum extract decreased the amounts of aldehydes at Day 0, and hydrocarbons and cyclo compounds at Day 7 of nonirradiated turkey roll, but had no effect in reducing the sulfur compounds. Aldehydes are known to contribute to oxidation flavor (rancidity) of cooked meat, and hexanal is the predominant aldehyde in cooked meat. Our results indicated that plum extract treatment showed reducing trends in lipid oxidation-dependent volatiles in turkey breast rolls, which agreed with the TBARS values.

Irradiation and storage had no effect on color L^* , a^* and b^* values, but plum extract increased redness (a^* -value) and yellowness (b^* -value) and decreased lightness (L^* value) in turkey breast rolls at 0 and 7 day. However, the color change of turkey breast rolls added with plum extract was caused by the original dark purple color of plum extract.

Irradiation and storage had no effect on the texture profile of turkey breast rolls. Plum extract slightly influenced the springiness, cohesiveness and resilience of irradiated and nonirradiated turkey breast rolls but the differences were very small and not consistent.

Sensory evaluation

According to the panel discussion, off-odor or off-flavor associated with irradiation was metal-like, oxidized, sulfur and sweet. The intensity of irradiation odor in irradiated samples was two times higher than those of nonirradiated samples, but plum extract had no effect in reducing the irradiation odor. This result agrees with the data for volatiles, in which plum extract had no effect in reducing the sulfur compounds in turkey breast rolls. Plum extract increased color intensity of turkey breast

rolls in sensory evaluation. Irradiation had no effect to color change in turkey breast rolls and sensory evaluation also agreed with those of CIE color analysis. Sensory panels found that irradiation had no effect on the texture of turkey breast rolls, but plum extract decreased hardness at $> 2\%$ level and increased juiciness at 3% level in irradiated samples. This indicates that plum extracts work as humectant, which naturally binds moisture and thus improves the texture of turkey breast roll from “dry” mouth-feel in low fat contents meat.

Conclusion

Addition of 3% of plum extract is recommended to improve mouth-feel and antioxidant effect in irradiated turkey breast rolls. However, the color of turkey rolls with 3% plum extract was dark and might not be appealing to consumers.

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