

COMPARATIVE EFFECT OF NATURAL AND SYNTHETIC ANIOXIDANTS ON MICROBIOLOGICAL QUALITY OF CHICKEN MEAT PATTIES DURING REFRIGERATION STORAGE

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Abstract: The present study was designed to evaluate the microbiological quality of chicken meat patties incorporated with natural antioxidant extracts i.e., rosemary (RE) and green tea (GTE) each at 2 % level and compare with synthetic antioxidant Butylated Hydroxy Anisole (BHA) at 0.01% under refrigeration ($4\pm 1^\circ\text{C}$) for a period of 8 days. Microbiological quality evaluation revealed that chicken meat patties incorporated with GTE at 2 % had significantly ($P < 0.05$) lower standard plate count and coliform count and protect against microbial attack more effectively when compared to control and other treatments. Also, a significant ($P < 0.05$) increase in microbial load ($\log_{10}\text{cfu/g}$) was noticed during refrigerated storage irrespective of treatments.

Keywords: Chicken meat patties, Green Tea extract, Rosemary Extract, BHA, Microbial studies.

Introduction

Recently consumers are focusing on health problems associated with microbial contamination in food, and looking for microbiologically safe meat products especially those prepared or preserved with natural substances rather than synthetics. Similarly the meat industry is looking for natural solutions to minimize microbial spoilage and extend the shelf-life of meat products rather than synthetic additives. Due to concerns about toxicological safety of synthetic antioxidants naturally derived antioxidants are perceived as better and safer than synthetics. Green tea leaf and rosemary extracts are becoming increasingly important as a functional food in the meat because of their high poly-phenol contents. The active anti oxidant and antimicrobial compounds of these extracts promote health by preventing lipid oxidation and providing antibacterial, anti-carcinogenic and antiviral ability. Hence the objective of the current research was to study the microbial quality of chicken meat patties with above natural and synthetic antioxidants during refrigerated storage.

Materials and methods

During this study six batches of chicken meat patties were prepared with natural and synthetic antioxidants i.e. RE at 2% (T₁), GTE at 2% (T₂) and BHA at 0.01% (T₃) separately. These patties were packed in low density polyethylene (LDPE) bags and stored at refrigeration temperature (4±1°C) up to 8 days. The refrigerated samples were drawn at an interval of two days (0, 2, 4, 6 and 8 days) and were analyzed for microbial counts along with control. The mesophilic (total plate count), the psychrophilic and the yeast and mould counts per gram of chicken meat patties at refrigerated (4±1°C) temperature were estimated as per the techniques recommended by Chestnut *et al.*, (1977). For coliform estimation Mac Conkey agar was prepared and 1ml of inoculum of each dilution was placed in duplicate petridishes. The sterile molten and cooled (45 °C) medium was poured in 15-20 ml quantities into each petridish and mixed thoroughly. The petridishes, after solidification of the medium were incubated at 37 °C for 18-24 hrs. Pink colored colonies were counted and expressed as log₁₀ cfu/g of sample. The data thus obtained was subjected to statistical analysis using SPSS MAC, version 20.0, SPSS Chicago (US).

Results and Discussion

Standard plate count:

Among the treatments chicken meat patties incorporated with GTE at 2% showed significantly (P<0.05) lower counts than the other treatments which might be due to the presence of polyphenolic catechins like epicatechin, epigallocatechin, epicatechin gallate, epigallocatechin gallate which causes irreversible damage to bacterial cytoplasmic membrane and check the microbial growth (Hara 2001). They also inhibit bacterial growth and protease activity by damaging the cell wall and cytoplasm, causing rapid structural destruction (Cowan, 1999). These results were in accordance with oh *et al.*, (2013), Lorenzo *et al.*, (2014) in foal meat, Indumathi and Obula reddy (2015) in chicken meat nuggets, Jamwal *et al.*, (2015) in chicken patties and Zhang *et al.*, (2016) in raw chicken meat. The overall mean bacterial count (log₁₀ cfu/g) decreased up to day 6th but significantly (P<0.05) increased counts were observed with increase in storage period during refrigeration. This might be due to the permissive temperature and relative availability of moisture and nutrients for the growth of mesophilic bacteria. These results were in consistent with Georgantelis *et al.*, (2007) in refrigerated pork sausages, Keokamnerd *et al.*, (2008) in ground chicken thigh meat and Szymanczuk *et al.*, (2011) in refrigerated pork batters.

Coliforms

The analysis of variance revealed that chicken meat patties incorporated with GTE at 2% showed significantly ($P < 0.05$) lower counts than the other treatments which might be due to the presence of polyphenolic catechins like epicatechin, epigallocatechin, epicatechin gallate, epigallocatechin gallate which causes irreversible damage to bacterial cytoplasmic membrane and check the microbial growth (Hara 2001). These results were coincided with reports of Juneja *et al.*, (2009) in sous-vide cooked ground beef, Rounds *et al.*, (2012) in cooked patties and Indumathi and Obula reddy (2015) in chicken meat nuggets. The overall mean coliform count (\log_{10} cfu/g) increased significantly ($P < 0.05$) with increase in storage period during refrigeration. This might be due to the permissive temperature and relative availability of moisture and nutrients for the growth of coliforms bacteria. These results were similar with Szymanczuk *et al.*, (2011) in refrigerated pork batters.

Psychrophiles:

Psychrophiles could not be detected in any of the treatments and control during refrigerated storage. This might be due to the temperature variance for growth of psychrophilic bacteria. The results were in agreement with Fernandez-Lopez *et al.*, (2005) in chilled beef meat balls, Chandralekha (2010) in refrigerated chicken meat balls, Indumathi and Obula reddy (2015) in chicken meat nuggets.

Yeast and Mold count:

Yeast and moulds were not detected in any of the treatments in the present study. This might be due to hygienic processing of practices and also might be attributed to the antifungal effect of extracts and spices. The results were in accordance with Cholan (2008) in low-fat chicken nuggets, Chandralekha (2010) in refrigerated chicken meat balls, Indumathi and Obula reddy (2015) in chicken meat nuggets.

Conclusion

Microbiological quality evaluation revealed that chicken meat patties incorporated with GTE at 2% level had significantly ($P < 0.05$) lower standard plate count and coliform count during refrigerated storage as compared to control and other treatments. Thus GTE not only extending the shelf life of the product but also protecting the health of the consumers as compared to RE, BHA and control during refrigerated storage.

Table 1: Standard plate count ($\log_{10}\text{cfu/g}$) values of chicken meat patties as influenced by different treatments during refrigerated storage ($4\pm 1^\circ\text{C}$).

Days of storage	Control	Treatments			Overall mean \pm S.E.
		T1	T2	T3	
0	4.81 \pm 0.010	4.25 \pm 0.010	4.04 \pm 0.009	4.49 \pm 0.009	4.39 \pm 0.13 ^b
2	5.12 \pm 0.010	3.59 \pm 0.009	3.25 \pm 0.010	4.18 \pm 0.009	4.03 \pm 0.02 ^a
4	5.60 \pm 0.010	3.91 \pm 0.009	3.68 \pm 0.010	4.50 \pm 0.009	4.42 \pm 0.05 ^b
6	5.95 \pm 0.010	4.36 \pm 0.009	4.05 \pm 0.009	4.82 \pm 0.009	4.79 \pm 0.05 ^c
8	6.89 \pm 0.009	4.71 \pm 0.009	4.42 \pm 0.010	5.91 \pm 0.010	5.48 \pm 0.15 ^d
Overall mean \pm S.E.	5.67 \pm 0.17 ^D	4.16 \pm 0.12 ^B	3.88 \pm 0.12 ^A	4.78 \pm 0.03 ^C	

($P < 0.05$); Means bearing at least one common superscript in the same row and in the same column do not differ significantly.

Table 2: Coliform count ($\log_{10}\text{cfu/g}$) values of chicken meat patties as influenced by different treatments during refrigerated storage ($4\pm 1^\circ\text{C}$).

Days of storage	Control	Treatments			Overall mean \pm S.E.
		T1	T2	T3	
0	2.31 \pm 0.07	2.14 \pm 0.01	1.99 \pm 0.03	2.19 \pm 0.01	2.16 \pm 0.03 ^a
2	6.24 \pm 0.03	1.92 \pm 0.02	1.24 \pm 0.01	2.82 \pm 0.02	3.05 \pm 0.02 ^b
4	7.98 \pm 0.02	2.04 \pm 0.01	1.87 \pm 0.02	3.28 \pm 0.02	3.79 \pm 0.02 ^c
6	8.81 \pm 0.09	3.43 \pm 0.02	3.01 \pm 0.03	4.01 \pm 0.05	4.81 \pm 0.02 ^d
8	9.01 \pm 0.07	4.67 \pm 0.09	3.86 \pm 0.03	6.08 \pm 0.01	5.91 \pm 0.15 ^e
Overall mean \pm S.E.	6.87 \pm 0.17 ^D	2.84 \pm 0.12 ^B	2.21 \pm 0.12 ^A	3.67 \pm 0.03 ^C	

($P < 0.05$); Means bearing at least one common superscript in the same row and in the same column do not differ significantly.

Treatments: Chicken meat sausages incorporated with

T₁ : 2 per cent Rosemary extract

T₂ : 2 per cent Green tea extract

T₃ : 0.01 per cent Butylated Hydroxy Anisole

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