Research Article

Comparative Effect of Green Tea Extract and BHA on Chicken Meat Nuggets During Frozen Storage

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Abstract

The present research was aimed to evaluate the comparative effect of natural antioxidant i.e., green tea extract (C*amellia sinensis*) (GTE) at 0.2 % level and synthetic antioxidant (BHA at 0.01% level) on chicken nuggets under frozen storage (-18±1ºC) for a period of 120 days. GTE treated nuggets showed significantly (P<0.01) lower values for pH, 2-TBARS and free fatty acid content during storage. Organoleptic evaluation indicated that addition of green tea extract at 0.2% registered significantly (P<0.01) higher sensory scores for various eating quality attributes than the other treatments. Considering the results obtained in the study, it may be concluded that addition of green tea extract at 0.2 % level is best by protecting the product longer against oxidative rancidity than synthetic BHA.

Keywords: Chicken meat nuggets, Green Tea Extract, BHA, Frozen study

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Introduction

Meat products are perishable food items and spoiled early due to lipid oxidation and microbial attack. The shelf life can be enhanced by addition of antioxidants. The synthetic antioxidants which are currently used for preservation of meat showing negative health effects and carcinogenicity. Further consumers are demanding the products with natural compounds. Hence the meat industry searched the new natural antioxidants from spices and herbs which are best alternative to synthetics. Thus, natural antioxidants have greater applications in the meat industry because they are rich in phenolic compounds. They can enhance the overall quality of food by decreasing lipid oxi-dation and microbial growth. Green tea extract is processed from the leaves and used in foods for some decades for its remarkable antioxidant features due to large amounts of tea catechins. These compounds may act as antioxidants by inducing antioxidant enzymes, inhibiting pro-oxidant enzymes or reacting with oxidant agents. Hence the present research has been designed to study the shelf life of chicken meat nuggets with natural GTE and synthetic BHA.

Materials and Methods

During this study six batches of chicken meat nuggets were prepared with green tea extract at 0.2 % (T_1) and Butylated Hydroxy Anisole (BHA) at 0.01% (T_2) separately and the control without any antioxidants. These nuggets were packed in low density polyethylene (LDPE) bags and stored at frozen temperature (-18±1ºC) for 3 months. The frozen samples were drawn at an interval of 30 days (0, 30, 60 and 90 days) and were analyzed for physico-chemical characteristics and eating quality along with control. $P^{H,}$ TBARS, free fatty acid and peroxide values of the product were determined as per the procedures of Jay [1], *Witte et al.*, [2], Pearson [3] and AOAC [4] respectively and subjected to organoleptic evaluation on a 9 point hedonic scale by a semi-trained five member taste panel. The data thus obtained was subjected to statistical analysis using SPSS MAC, version 20.0, SPSS Chicago (US).

Results and Discussion

pH

The results showed that pH values of nuggets with GTE at 0.2% had significantly (P<0.01) lower values than BHA treatment and control and increased significantly (P<0.01) during storage period which might be due to the

accumulation of metabolites by bacterial action in meat in addition to protein and amino acid degradation resulting in formation of ammonia and consequent increase in pH. The results were in agreement with Gai *et al.*, [5] in frozen fillets, Jamwal *et al*., [6] in chicken meat patties and Nath *et al*., [7] in chevon patties.

TBARS

In the present study, the overall mean TBA values of GTE treated samples were significantly (P<0.01) lower than BHA and control throught storage. This might be due to large amount of poly-phenolic compounds like catechins, epicatechin, epigallocatechin, epicatechin gallate, epigallocatechin gallate, gallocatechin gallate, catechin gallate and gallocatechin (Zandi and Gondon [8]. The TBA values of control and all treatments significantly (P<0.01) increase in during storage. This might be due to auto-oxidation of lipids over a period of low temperature storage and pro-oxidant nature of added salt. Similar results were found by Gai *et al.*, [5] in frozen fillets, Jamwal *et al*., [6] in chicken meat patties, Nath *et al*., [7] in chevon patties and Pires *et al*., [9] in frozen chicken burgers.

Free fatty acids

The overall mean free fatty acid values (per cent oleic acid) of chicken meat sausages increased gradually with increased storage periods and GTE treated samples secured (P<0.01) lower values than others. This increase might be due to progressive oxidation of lipids during storage. The results were in agreement with Chandralekha [10] in frozen chicken meat balls and Wagh *et al*., [11] in pork frankfurters.

Table 1 Mean ± S.E values of pH, 2-TBARS and free fatty acid values of chicken meat nuggets as influenced by different treatments during frozen storage (-18±1°C)

Days of storage	Control	Treatments		Overall mean ± S.E.
		T1 (0.2 %GTE)	T2 (0.001 BHA)	
pH				
0	6.08±0.005	5.92±0.003	5.96±0.005	5.98±0.005^{a}
30	6.15±0.003	6.01±0.020	6.12±0.003	6.09±0.02^{b}
60	6.21±0.007	6.13±0.005	6.20±0.001	6.18±0.01^{c}
90	6.30±0.01	6.18±0.02	6.29±0.01	6.25±0.01^{d}
Overall mean ± S.E.	6.18±0.06^{C}	6.06±0.02^{A}	6.14±0.02^{B}	
2-TBARS values				
0	0.26±0.003	0.18±0.006	0.19±0.001	0.21±0.01^{a}
30	0.41±0.010	0.23±0.002	0.32±0.001	0.32±0.02^{b}
60	0.75±0.010	0.35±0.010	0.44±0.010	0.51±0.06^{c}
90	0.98±0.040	0.49±0.010	0.76±0.010	0.74±0.08^{d}
Overall mean ± S.E.	0.60±0.2^{C}	0.31±0.05^{B}	0.43±0.04^{A}	
Free fatty acid values				
0	0.035±0.0004	0.021±0.0006	0.025±0.0002	0.027±0.0004^{a}
30	0.045±0.0001	0.025±0.0001	0.030±0.0001	0.033±0.0004^{b}
60	0.051±0.0002	0.039±0.0002	0.042±0.0001	0.044±0.0004^{c}
90	0.062±0.0005	0.044±0.0002	0.059±0.0002	0.055±0.0006^{d}
Overall mean ± S.E.	0.048±0.0102^{C}	0.032±0.0009^{A}	0.039±0.0007^{B}	

Peroxide value

Peroxides could not be detected in any of the samples during refrigerated and frozen storage. This might be due to the fact that, there was no higher degree of fat deterioration during storage as the products were acceptable throughout frozen storage. The results were in agreement with Chandralekha [10] in frozen chicken meat balls.

Sensory Evaluation

Chicken meat nuggets with 0.2% GTE secured significantly (P<0.01) higher flavor, juiciness, tenderness and overall

acceptability than the others. All organoleptic parameters showed significantly (P<0.01) decreased trend during frozen period. Reduction in flavour score might be due to the overall reduction in the quantity of volatile flavour components and due to oxidation of fat during storage. Decrease in juiciness was due to loss of moisture in the form of evaporation. The reduction in mean tenderness scores during refrigerated storage might be due to the relative reduction in moisture and juiciness of the product that led to hardening of the product. Similar reports were noticed by Ferial M. Abu-Salem *et al*., [12] in frozen luncheon roll, Jamwal *et al*., [6] in chicken meat patties and Nath *et al*., [7] in chevon patties.

Table 2 Mean ± S.E values of organoleptic characteristics of chicken meat nuggets as influenced by different treatments during frozen storage (-18±1°C)

Days of storage	Control	Treatments		Overall mean ± S.E.
		T1 (0.2 %GTE)	T2 (0.001 BHA)	
Flavour				
0	7.95±0.35	8.25±0.02	8.10±0.03	8.10 ± 0.08^{d}
30	7.60±0.36	8.10±0.12	7.86±0.03	7.85 ± 0.09^{c}
60	6.92±0.16	7.98±0.03	7.50±0.15	7.46 ± 0.06^{b}
90	6.35±0.21	7.47±0.01	6.95±0.20	6.92 ± 0.09^{a}
Overall mean ± S.E.	7.20 ± 0.13^{A}	7.95 ± 0.06^{B}	7.60 ± 0.07^{C}	
Juiciness				
0	8.34±0.01	8.65±0.01	8.38±0.03	8.45 ± 0.01^{c}
30	7.51±0.01	8.02±0.01	7.75±0.06	7.76 ± 0.01^{b}
60	7.05±0.01	7.98±0.01	7.21±0.01	7.41 ± 0.01^{b}
90	6.45±0.02	7.64±0.02	6.75±0.01	6.94 ± 0.01^{a}
Overall mean ± S.E.	7.33 ± 0.07^{A}	8.07 ± 0.06^{B}	7.52 ± 0.06^{A}	
Tenderness				
0	8.13±0.21	8.65±0.03	8.36±0.18	8.38 ± 0.07^{d}
30	7.61±0.23	8.45±0.02	8.21±0.23	8.09 ± 0.08^{c}
60	7.14±0.22	8.05±0.02	7.84±0.21	7.67 ± 0.42^{b}
90	6.36±0.21	7.88±0.03	6.95±0.25	7.06 ± 0.09^{a}
Overall mean ± S.E.	7.31 ± 0.12^{A}	8.25 ± 0.07^{C}	7.84 ± 0.11^{B}	
Overall acceptability				
0	8.15±0.22	8.56±0.02	8.35±0.02	8.35 ± 0.05^{d}
30	7.75±0.34	8.30±0.05	8.10±0.05	8.05 ± 0.09^{c}
60	7.34±0.20	7.98±0.07	7.72±0.07	7.68 ± 0.06^{b}
90	6.84±0.21	7.78±0.04	7.43±0.04	7.35 ± 0.06^{a}
Overall mean ± S.E.	7.52 ± 0.11^{A}	8.15 ± 0.07^{B}	7.90 ± 0.06^{C}	

(P<0.01): Means bearing at least one common superscript in the same row and in the same column do not differ significantly.

Conclusion

Finally concluded that addition of GTE at 0.2 % level would protect the product longer against oxidative rancidity but also had higher acceptability as GTE treated nuggets have significantly (P<0.01) lowest pH, TBARS and free fatty acid values and significantly (P<0.01) higher sensory scores throughout frozen period than synthetic BHA and control.

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