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Proteolytic Changes in Chicken Meat Packed in Ecofriendly Packaging Materials

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ABSTRACT

The present study was undertaken to evaluate the proteolytic changes that occurs during storage of chicken meat packed in ecofriendly packaging materials at refrigeration temperature of at 4 ± 1 ^{0} C. Ecofriendly packaging materials are prepared in Department of Meat Sceince and Technology, Madras Veterinary College with dies especially designed for this study purpose. Chicken drumsticks were packed in ecofriendly packaging materials viz. Areca Sheath trays (T_1) Coconut shell trays (T_2) and commercially available Styrofoam trays (control) to evaluate the proteolytic changes that occurs during storage such as TBA (Thiobarbituric acid number) and TV (Tyrosine value) at 0, 1, 3 and 5 days interval.

Key words: *Ecofriendly Packaging, Proteolysis, Chicken Meat.*

INTRODUCTION

Plastic materials cannot be decomposed or degradable by natural processes. They have long-lasting effects on landfills, where as the toxic pollutants often results in contamination of ground water sources and also leads to out-gassing. Long-term exposure to the environment can cause petroleum-based plastics to secrete toxic pollutants. The packaging materials available in market are based on petroleum based polymers which act as potent source of ecological pollution. In order to protect our surroundings from the ill effects of petroleum based polymers, development of ecofriendly packaging materials is the necessary need in future. Protelolysis is a common phenomenon in chicken meat while storage at refrigeration with increase in storage period. Limited studies are undertaken with chicken meat packed in ecofriendly packaging materials and its proteolytic that occurs while storage at refrigeration temperature. So the present study was undertaken to evaluate the proteolytic changes that occurs during storage of chicken meat packed in ecofriendly packaging materials at refrigeration temperature of at 4 ± 1^0 C utilizing Coconut shell powder and Areca sheath trays in comparison with commercially available Styrofoam trays.

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MATERIALS AND METHODS

Preparation of Areca sheath trays

The Areca sheath trays were prepared by immersing the areca sheath in cold water for about 20 minutes and then thoroughly cleaned and dried. The trays were prepared by applying pressure for 30 seconds over the cleaned dust free Areca sheaths using electrically operated aluminum die. The edges of trays were smoothened by using grinding machine. Then the trays were exposed to UV rays for 5 minutes for sterilization. The trays were painted with molted paraffin wax to provide a thin layer coating to avoid seepage of chicken meat exudates into the trays.

Preparation of Coconut shell powder trays

The coconut shell powder trays were prepared by blending coconut shell powder with Acacia gum powder to make a paste and then pressed to the desirable tray shape by using steel mould developed for the purpose. The trays are dried for 8 hours in sun. The plates were coated with molted paraffin wax to provide a thin layer coating to avoid oozing out or seepage of chicken meat stored. Later the trays were exposed to UV rays for 5 minutes for sterilization.

Fresh chicken drumstick parts were bought from local meat market in Vepery and brought hygienically to the Department of Meat Science and Technology. The trays used for packaging of meat are initially kept in UV chamber for 20 minutes for sterilization. The chicken drumsticks were packed in different packaging materials viz, Areca sheath trays (T_1) coconut shell powder trays (T_2) and Styrofoam trays (control) and covered with cling wrap on top and then stored at a temperature of 4 ± 1ºC in refrigerator. The Areca sheath trays and coconut shell powder trays were coated with edible paraffin wax prior to sterilization. The Thiobarbituric acid number and Tyrosine value were assessed and recorded at 0, 1, 3 and 5 days interval.

Analytical procedures

Thiobarbituric acid number (TBA)

Trichloro acetic acid (TCA) extract

Twenty grams (20g) of meat sample was blended in the laboratory blender (Remi, India) with 50ml of cold 20 percent Trichloro acetic acid (TCA) for 2 minutes. The blended contents were rinsed with 50 ml of distilled water and filtered through Whatman No.1 filter paper (18.5cm diameter) and the filtrate was collected in a 100 ml capacity measuring cylinder. The filtrate, termed the Trichoroacetic acid (TCA) extract was used in the estimation of Thiobarbituric acid number (TBA) and Tyrosine value (TV).

Thiobarbituric acid reagent (TBA)

Thiobarbituric acid (TBA) reagent was prepared with reference to earlier studies[1]. Dissolving 0.2883 g of Thiobarbituric acid in sufficient quantity of 90 percent acetic acid and by slight warming to dissolve the contents. Then the volume is made up to 100 ml with 90 percent glacial acetic acid.

Thiobarbituric acid (TBA) number was measured by the modified method[2]. Five ml of TCA extract was mixed with 5 ml of TBA reagent in a test tube. The test tube was kept in a water bath at 100°C for 30 minutes along with a blank test tube containing 5 ml of 10 percent Trichloro acetic acid (TCA) and 5 ml of TBA reagent. After cooling the tubes in running tap water for 10 minutes. The developed colour was measured as absorbance value at 530 nm using spectrophotometer (SL–164, Double Beam UV–VIS spectrophotometer, ELICO India Ltd, Hyderabad) at medium sensitivity and reported as TBA number.

Tyrosine Value (TV)

Tyrosine value was determined by the modified method[2]. Two and a half millilitre of TCA extract was diluted with equal quantity of distilled water in a test tube. To this 10 ml of 0.5 N sodium hydroxide was added followed by 3 ml of diluted Folin Coicalteau's phenol reagent (1 part Folin Ciocalteau's phenol reagent with 2 parts distilled water). After mixing and keeping for 15 minutes at room temperature the developed colour was measured as absorbance at 660 nm in a spectrophotometer (SL–164, double beam UV–VIS spectrophotometer, ELICO India Ltd., Hyderabad) at low sensitivity, using a blank containing 5 ml of 10 percent

Trichloroacetic acid (TCA) with 10 ml of 0.5 N sodium hydroxide and 3ml of diluted Folin Ciocalteau's phenol (FCP) reagent. By reference to the standard graph, the tyrosine value was calculated as mg of tyrosine per 100 g of sample.

Standard Graph for estimation of Tyrosine value

Hundred milligrams (100 mg) of tyrosine was dissolved in 500 ml of 5 percent Trichloro acetic acid (TCA) in a volumetric flask. The following volumes of the above tyrosine solution were then transferred to a series of 100 ml volumetric flasks: 0, 1, 3, 5, 7, 10, 15, 20, 25, 30, 35, 40, 45 and 50ml. They were made up to the mark with distilled water and mixed thoroughly. Five ml of each of the tyrosine solution were mixed and shaken with 10 ml of 0.5 N sodium hydroxide and 3 ml of diluted Folin Ciocalteau's phenol (FCP) reagent and then treated as described for tyrosine value. The standard graph was prepared with known concentration of tyrosine in the solution and their corresponding absorbance values following the least square method.

The data collected were subjected to statistical analysis in SPSS software as per the standard procedure[3].

RESULTS AND DISCUSSION

Thiobarbituric acid number (TBA)

The analysis of variance revealed a significant difference ($p<0.05$) in TBA between different packaging materials and storage periods. However, no significant difference ($p>0.05$) observed in interaction between treatments and storage period (Table 1). The initial TBA of chicken drumsticks on day 0 was 0.01 ± 0.00. The mean ± S.E values of TBA of chicken drumsticks packed and stored in Areca sheath trays, Coconut shell powder trays and Styrofoam trays on day 5 are 0.08 ± 0.00, 0.05 ± 0.01 and 0.06 ± 0.01 respectively. TBA reported an increasing trend during storage period and the results obtained were in agreement with previous findings[4,5], who observed that TBA of chicken meat increased with increase in storage days. Chicken drumsticks stored in Areca sheath trays revealed high TBA followed by Styrofoam trays and Coconut shell powder trays on day 5 of storage.

Table 1: Mean ± SE values of Thiobarbituric acid of chicken drumsticks packed in different packaging materials and stored at 4 ± 1ºC

TBA	Days	Areca sheath tray	Coconut shell powder tray	Styrofoam tray	Overall mean Storage Period
	Day 0	0.01 ± 0.00^{aA}	0.01 ± 0.00^{aA}	0.01 ± 0.00^{aA}	0.01 ± 0.00^{X}
	Day 1	0.02 ± 0.01^{aAB}	0.02 ± 0.01^{aAB}	0.03 ± 0.01^{aA}	0.02 ± 0.01^{Y}
	Day 3	0.04 ± 0.01^{aB}	0.03 ± 0.01^{aB}	0.03 ± 0.01^{aA}	0.03 ± 0.00^{Y}
	Day 5	0.08 ± 0.00^{bC}	0.05 ± 0.01^{aC}	0.06 ± 0.01^{aB}	0.07 ± 0.01^{Z}
	Over all mean Treatment	0.04 ± 0.00^{X}	0.02 ± 0.00^{Y}	0.03 ± 0.00^{Y}	

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) and between overall mean (X, Y, Z) differ significantly ($p<0.05$) or ($p<0.01$).

Tyrosine Value (TV) (mg of tyrosine/100g)

The analysis of variance revealed no significant difference ($p>0.05$) in TV between different packaging materials and interaction between treatments and storage periods, whereas a significant difference ($p<0.05$) was observed between storage periods. (Table 2)

The initial TV of chicken drumsticks on day 0 was 10.07 ± 1.22. The mean ± S.E values of TV of chicken drumsticks packed and stored in Areca sheath trays, Coconut shell powder trays and Styrofoam trays on day 5 are 21.78 ± 1.58, 19.19 ± 1.67 and 18.72 ± 2.04 respectively.

The tyrosine value of chicken carcasses significantly increased during the advancement of storage period irrespective of treatments. The results are accordance with earlier findings which also reported an increase in tyrosine value in meat products with increase in the storage period[6]. The free amino acid of the product increased its tyrosine values which were attributed to the microbial proteolysis activity due to increased microbial counts during prolonged storage.

The results obtained in this study were in agreement with previous findings that also observed that TV increases with increase in storage period irrespective of packaging materials[7]. Chicken drumsticks stored in Areca sheath trays revealed high TV followed by Styrofoam trays and Coconut shell powder trays on day 5 of storage.

Table 2: Mean ± SE values of Tyrosine value of chicken drumsticks packed in different packaging materials and stored at 4 ± 1ºC

TV	Days	Areca sheath tray	Coconut shell powder tray	Styrofoam tray	Overall mean Storage Period
	Day 0	$10.07 \pm 1.22^{a\,A}$	10.07 ± 1.22^{aA}	10.07 ± 1.22^{aA}	10.07 ± 0.66^{X}
	Day 1	12.72 ± 1.07^{aAB}	9.81 ± 0.91^{aA}	11.53 ± 1.04^{aA}	11.35 ± 0.62^{X}
	Day 3	15.14 ± 1.81^{aB}	14.91 ± 2.11^{aB}	16.16 ± 1.47^{aB}	15.40 ± 0.99^{Y}
	Day 5	21.78 ± 1.58^{aC}	19.19 ± 1.67^{aB}	18.72 ± 2.04^{aB}	19.90 ± 1.02^{Z}
	Over all mean Treatment	14.92 ± 0.74^{X}	13.49 ± 0.74^{X}	14.11 ± 0.74^{X}	

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) and between overall mean (X, Y, Z) differ significantly ($p<0.05$) or ($p<0.01$).

CONCLUSION

Based on the results of proteolytic changes , coconut shell powder trays and styrofoam trays were evenly good enough to store chicken drumsticks at 4 ± 1º C until 3 days. However, biodegradability, effective utilization of raw material for preparation of coconut shell powder and prevention pollution to the atmosphere pollution makes it more greater than commercially market available styrofoam trays for storage of chicken drumsticks. The preparation of coconut shell powder trays will help in employment of village people by acting as a effective raw material in preparation of eco friendly packaging material.

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