J.Meat Sci., 2011, 7(2) : 17 - 20 Research Paper

Effect of Aerobic Packaging and Addition of Pomegranate Peel Extract on Physicochemical Characteristics of Ground Broiler Meat

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ABSTRACT

In this study effect of aerobic packaging and pomegranate peel extract on ground chicken meat during refrigerated storage was evaluated. Addition of extract increased the drip loss but did not affect the pH. Use of heat sealing and extract significantly reduced the TBARS values indicating antioxidant effect of pomegranate peel extract. Accumulation of CO_2 was higher in aerobic packaged meat without heat sealing. Aerobic packaging was having beneficial effects in preserving the red colour and colour intensity of refrigerated stored chicken meat. It was concluded that addition of pomegranate peel extract improved the oxidative stability of aerobically packaged poultry meat.

Key words: *Poultry meat, pomegranate peel extract, head space gas, TBARS*

INTRODUCTION

In India, poultry meat is generally marketed without any primary processing and packaging at the wholesaler or retailer level. In recent years, there has been an increase in the demand for convenience and semi-convenience meat products like minced meat (kheema), kebabs, kofta, tikka etc. However these products are commonly sold without any packaging and have very limited shelf life. Simple techniques like aerobic packaging of minced meat using easily available LDPE/HDPE would effectively protect the meat from its environment and attract the consumer to give aesthetic look to the meat products. Further use of antioxidants like BHT, BHA delay or prevent lipid oxidation by reducing free radical activities in meat. However synthetic antioxidants might have adverse effects on consumers health. Recent studies have focused attention on development of natural antioxidants from plant origin. Naveena *et al* (2008) and Devatkal *et al* (2010) have reported the potential antioxidant effect of pomegranate peel extracts in chicken and goat meat patties respectively. Hence, the present investigation was carried out to evaluate the effect of aerobic packaging and pomegranate peel extract on physicochemical characteristic of minced chicken meat.

MATERIALS AND METHODS

Fresh broiler meat was obtained from local retail meat shop and stored at 4°C for 12 h and 3 kg of poultry meat was minced twice (10 mm plate followed by 8 mm plates using a meat mincer (INALSA,Delhi, India). Ground meat samples (500g each) were assigned three treatments : I) T1.Control (meat packaged aerobically in LDPE bags without heat sealing), II) T2 (meat packaged aerobically in LDPE bags and heat sealed using a packaging machine), III) T3 (5% w/v pomegranate peel extract was added to meat and packaged aerobically and heat sealed). Sub-samples (75 g each) from each treatment were prepared and stored at 4 ±1°C for 9 days. During storage drip loss was calculated, instrumental colour was monitored using Hunter lab colorimeter (L,a, b, Hue and Chroma values); lipid oxidation by measuring TBARS (thiobarbituric acid reactive substances values); and oxygen and carbon dioxide levels were also

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monitored using gas analyser. All the parameters were studied at an interval of three days.

A clean blotting paper was used to absorb the exudates collected in packs and the total loss in weight was expressed as drip loss. For estimating pH ten grams of minced meat sample was thoroughly homogenized with 50 ml of distilled water. The pH value of homogenate was recorded using a digital pH meter. Colorimetric analysis on ground chicken breast was performed as per the method of Hunter and Harold (1987). Hunter Lab Miniscan XE Plus colorimeter was used for the same. Headspace gas composition was evaluated using a gas analyser (D902, Quantek Instruments, USA) using the method of Ayhan *et al.* (2008). Thiobarbituric acid reacting substances (TBARS in mg malonaldehyde /kg meat) values were estimated using extraction method described by Witte *et al.* (1970).

The experiment was replicated twice and all parameters were measured in duplicate. Data were subjected to analysis of variance (ANOVA) and the least significant difference (LSD) test at 95% confidence level using SPSS software program version 13.0. The effects of treatments, storage and their interactions on the quality parameters were evaluated.

RESULTS AND DISCUSSION

Overall treatment means of physicochemical characteristics of three treatments are shown in Table1. The changes in physicochemical characteristics of ground broiler meat during refrigerated storage are depicted in Table 2. There was no significant effect of treatment on the pH of ground chicken meat. However pH initially increased and then slightly decreased on later days of storage in all treatments. The initial increase in pH may be attributed to production of nitrogenous compounds due to proteolysis and later decrease in pH due to lactic acid production by micro organisms (Aksu *et al.* 2005). The headspace gas compositions revealed that oxygen concentration did not change significantly during first six days of storage but a slight decrease in oxygen concentration was observed on 9th day of storage. This decrease in O_2 concentration might be due to oxidative reaction and growth of aerobic spoilage microorganisms. The CO_2 concentration (Fig.1) gradually increased during storage period ($P<0.05$) and was highest in control as compared to other treatments. The increase in CO_2 concentration was probably due to microbial spoilage.

Drip loss was significantly ($P<0.05$) lower in T1 as compared to T2 and T3. The probable reason may be the pressure exerted on meat sample during heat sealing. A significant increase in drip loss during subsequent storage period was also observed. Hunter colour values showed that lightness values (L) was not affected by the treatments and storage period. Redness values (a), were significantly ($P<0.05$) higher in T1 and T2 as compared to T3. Further redness decreased during storage in all treatments. The decrease in redness may be attributed to brownish discolouration due to formation of metmyogblobin.Values for yellowness (b) were significantly higher in T1 than T2 and T3. Chroma values (colour intensity) were significantly higher in control as compared to T1 and T2. Further a non significant decrease in chroma values during storage was observed in all treatments. In general, higher oxygen levels in packages causes severe discolouration of meat products (Moller *et al.* 2000). In this study, simple aerobic packaging tends (T1) to preserve the redness of meat for a longer period as compared to heat sealed packing (T2).

Oxidative stability was measured using TBARS values and the results are shown in Fig 2. A significant ($P<0.05$) increase in TBARS values was observed during storage period. Overall

Table 1: Overall changes in different physicochemical characteristics of ground chicken meat stored at 4±1 °C.

	Storage Period				
Treatments	**0 day**	**3 days**	**6 days**	**9 days**	**SE**
			pH		
T1	5.83	6.01	5.78	5.75	0.15
T2	5.57	5.92	5.81	5.87	0.17
T3	5.85	5.86	5.76	5.48	0.17
			Oxygen in head space (%)		
T1	20.57	20.32	20.35	19.62	0.94
T2	21.95 ^{a}	20.15	20.12	18.52 ^{b}	1.12
T3	22.20 ^{a}	20.47	20.76	18.64 ^{b}	1.31
			Drip loss (%)		
T1	0.14 ^{a}	0.89 ^{b1}	1.20 ^{c1}	2.41 ^{d1}	0.13
T2	0.18 ^{a}	1.21 ^{b1}	2.85 ^{c2}	3.54 ^{d2}	0.24
T3	0.17 ^{a}	1.45 ^{b2}	3.41 ^{c3}	2.35 ^{d1}	0.21
			Hunter L value		
T1	52.60	55.54	54.95	53.92	1.57
T2	53.36	54.17	57.03	55.64	1.84
T3	51.53	52.91	54.54	53.33	1.73
			Hunter a value		
T1	9.94 ^{a1}	7.56 ^{b}	8.01 ^{b1}	7.78 ^{b}	0.46
T2	8.33^{2}	8.35	7.09	7.56	0.67
T3	8.12 ^{a2}	6.90 ^{b}	5.68 ^{b2}	5.27 ^{c}	0.58
			Hunter b value		
T1	15.73 ^{1}	15.72	15.12 ^{1}	14.86 ^{1}	0.62
T2	13.34 ^{2}	14.42	13.83 ^{2}	13.85 ^{1}	0.48
T3	13.98 ^{3}	14.21	12.88 ^{2}	12.80 ^{2}	0.56
			Hue value		
T1	57.71 ^{b}	64.24 ^{a} 1	62.12 ^{a}	62.31 ^{a}	11.89
T2	57.99	59.89^{2}	62.85	61.35^{1}	2.34
T3	59.98 ^{b}	64.08 ^{a}1	66.18 ^{a}	67.56 ^{a}2	2.74
			Chroma value		
T1	18.61^{2}	17.45	17.12^{1}	16.77^{1}	0.86
T2	15.73^{1}	16.66	15.55^{2}	15.80^{2}	0.73
T3	16.18 ^{a}1	15.79 ^{b}	14.08 ^{b2}	13.84 ^{b3}	0.68

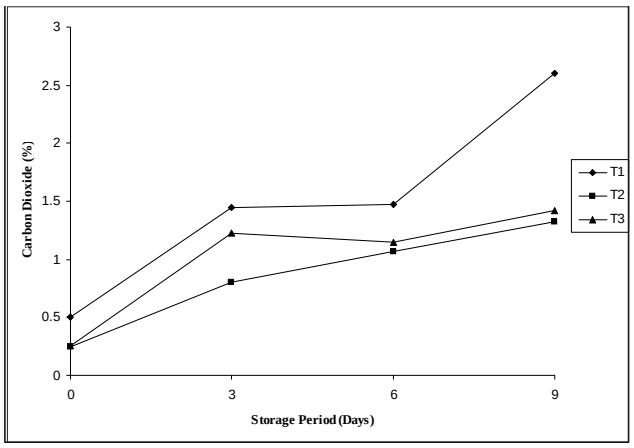
Means with different superscripts within a row (alphabets) and column (numericals) differ significantly (P<0.05),
SE = Standard error

T1-Aerobic packaging without heat sealing; T2- Aerobic packaging with heat sealing and T3- Aerobic packaging with pomegranate peel extract and heat sealing

treatments means indicated lower TBARS values in T3 followed by T2 and T1. Heat sealing decreased the TBARS values indicating less lipid oxidation in T2 as compared to control. Further addition of pomegranate peel extract also decreased the TBARS values. Overall storage means indicated an average 345% percent increase in TBARS values during storage. Further observations on treatment means revealed a decrease in TBARS values by 12% in T2 and 24 % in T3 as compared to control sample. Earlier studies have also shown the antioxidant effect of pomegranate peel extract in chicken meat and meat products (Devatkal *et al.* 2010; Naveena *et al.* 2008).

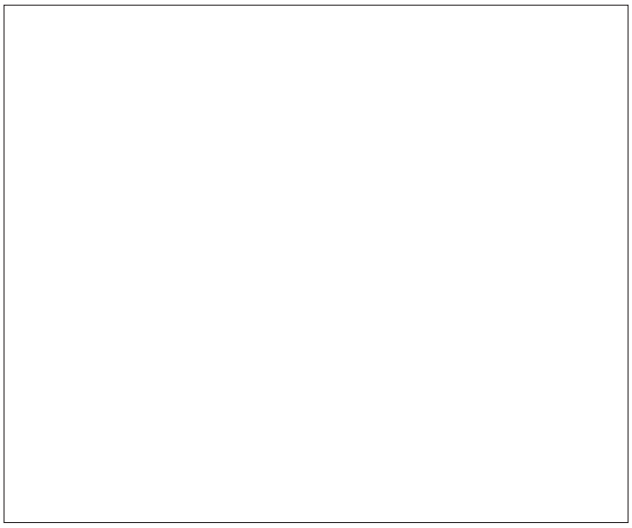
Thus, the results of above study indicated the antioxidant effect of pomegranate peel extract and

Figure 1: Effect of aerobic packaging and pomegranate peel extract on carbon dioxide concentration in head space of aerobically packed ground chicken meat stored at 4±1 °C .



T1-Aerobic packaging without heat sealing; T2- Aerobic packaging with heat sealing and T3- Aerobic packaging with pomegranate peel extract and heat sealing.

Figure 2: Effect of aerobic packaging and pomegranate peel extract on TBARS values of aerobically ground chicken meat stored at 4±1 °C.



T1-Aerobic packaging without heat sealing; T2- Aerobic packaging with heat sealing and T3- Aerobic packaging with pomegranate peel extract and heat sealing.

useful effect of aerobic packaging in maintaining the colour stability of ground broiler meat.

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