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Research Article

CHANGES IN THE QUALITY OF DRESSED CHICKEN OBTAINED FROM DIFFERENT SOURCES DURING FROZEN STORAGE

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ABSTRACT: This present study examines the preservation quality of dressed chicken procured from different sources of processing during storage at –18±1ºC. Breast portion of the dressed birds obtained from three different sources, *viz.* market/road side slaughtered chicken (MSC), retail slaughtered chicken (RSC), and scientifically slaughtered chicken (SSC), were cut into chunks, divided into 250 g portions, packed in polyethylene bags, stored at –18±1ºC and evaluated at 30 days intervals for changes in quality attributes. Frozen storage had no marked influence on pH change of the samples. SSC samples had higher extract release volume (15.34±0.08 to 13.45±0.93 ml) than MSC (13.00±0.19 to 9.91±0.97 ml) and RSC samples (13.65±0.24 to 11.70±1.21ml). There was significant increase (P<0.05) in thiobarbituric acid of all three sample types during storage but values were well below the threshold level of spoilage. SSC samples showed lower tyrosine content throughout frozen storage compared to MSC and RSC samples. A significant decline in microbial load, *viz.* total viable count, coliform count, psychrophilic count and yeast and moulds count were noticed during frozen storage. Organoleptic attributes, *viz*. appearance, flavour, texture and overall palatability were not affected due to frozen storage except juiciness in MSC samples which decreased (P<0.05) from 6.53±0.13 to 5.96±0.11 on 90 days of storage. Although the scientifically slaughtered chicken had better quality, all the sample types could be stored at –18±1ºC till 90 days without much deterioration in their quality.

Keywords: Chicken meat, Frozen storage, Hygienic slaughter, Market sources, Quality.

INTRODUCTION

In India meat is mostly sold as freshly cut and dressed in open markets without much consideration of hygiene. Lack of proper knowledge and infrastructure for hygienic processing and handling of chicken carcasses in the retail shops make such meat contaminated resulting in public health problems (Mukhopadhyay *et al.*, 2004). Evaluation of microbial quality of fresh chicken dressed under different processing conditions revealed marked differences in their physico-chemical and microbiological qualities (Santosh Kumar *et al.*, 2011, 2012). But with globalization and changing consumer preferences, many urban consumers now prefer hygienically processed and frozen meat and meat products from super markets or different company outlets. At the

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same time, any frozen meat at pretty road side shops or small retailers are considered stale or of inferior quality. There is paucity of data on shelf-life and quality of frozen meat which is becoming a convenient way of marketing chicken in cities in the country. The objective of this study was to evaluate the changes in the quality of chicken dressed under different conditions during frozen storage.

MATERIALS AND METHODS

Sources of samples:

Dressed boiler chicken slaughtered under different conditions, *viz*. (1) market slaughtered chicken (MSC) from temporary market or road side meat shops, (2) retail slaughtered chicken (RSC) from permanent retail outlets having a permanent structure and better amenities , and (3) chicken (scientifically slaughtered chicken, SSC) from hygienic semi-automatic poultry processing plant at the Department of Livestock Products Technology, Rajiv Gandhi Institute of Veterinary Education and Research, Pondicherry, India were procured fresh, collected in low density polyethylene (LDPE) packages and transported to the laboratory under ice cover. Breast cut of each bird was separated and used for the study. Each breast was cut longitudinally and subsequently made into 5-6 cm^3 chunks taking precautions to avoid cross-contamination. The chicken breast chunks were divided into 250 g portions and packed in LDPE bags, sealed and stored at –18±1ºC. Samples were drawn and analyzed on day 0, 30, 60 and 90 to monitor the changes in chemical/biochemical, microbiological and organoleptic qualities during cold preservation.

Analysis of samples:

pH of the samples was measured with a digital pH meter (Model LE 120, ELICO) following AOAC (1995). Extract release volume (ERV) of the meat samples was estimated following Pearson (1968), with modifications suggested by Santosh Kumar *et al.* (2012). Thiobarbituric acid (TBA), and Tyrosine value (TV) of samples were measured following Witte *et al*. (1970) and Strange *et al.* (1977) respectively. All the samples were analyzed in duplicate. Total viable bacterial count (TVC), coliform count, psychrophilic count (PPC) and Yeast and mould count (YMC) of the samples were determined following APHA (1984) using different dehydrated media (Hi-Media Laboratories, Mumbai) for different microbial groups.

For sensory evaluation, chicken breast chunks were marinated with 1.5% salt (NaCl), 0.1% turmeric powder and 10% water for 10 minutes followed by pressure cooking at 1.1kg cm^{-2} pressure for 10 minutes. Organoleptic attributes, *viz*. appearance, flavour, juiciness, texture and overall palatability of samples were evaluated by semi-trained panelists using 8 point hedonic scale (8 – like extremely; 1 – dislike extremely).

A total of four trials using 48 broilers were conducted. Data were analyzed following two-way Analysis of Variance (ANOVA) and levels of significance were tested using the least significant difference (LSD) test following Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Frozen storage of chicken meat did not affect the pH of the samples, which varied from 5.70 ± 0.09 to 6.03 ± 0.18 (Table 1) over a period of 90 days. Similar results were reported by Kesava Rao and Kowale (1988) with buffalo meat during frozen storage at -10ºC for 90 days, but contradicts with Das *et al.* (2004), who observed significant ($P<0.05$) increase in pH

Table 1: **Changes in biochemical properties of chickens from different sources during frozen storage (–18±1ºC) (Mean ± SE).**

Parameters	Samples	Storage days			
		0	30	60	90
pH	MSC	5.87±0.04	5.97±0.13	6.03±0.18	6.02±0.06^{a}
	RSC	5.82±0.05	5.88±0.07	5.77±0.07	5.83±0.07^{b}
	SSC	5.75±0.05	5.70±0.09	5.80±0.04	5.76±0.06^{b}
ERV (ml)	MSC	13.00±0.19^{a}	11.35±1.27^{a}	9.91±0.97^{a}	11.03±0.70^{a}
	RSC	13.65±0.24^{b}	14.09±0.78^{b}	11.70±1.21^{a}	12.78±1.59^{a}
	SSC	15.34±0.18^{c}	15.36±0.38^{b}	13.71±1.16^{b}	13.45±0.93^{b}
TBA (mg malonaldehyde/ kg)	MSC	0.48±0.02^{aA}	0.67±0.01^{aB}	0.74±0.06^{aC}	0.76±0.02^{aC}
	RSC	0.42±0.19^{bA}	0.63±0.01^{aB}	0.71±0.03^{aC}	0.81±0.03^{bD}
	SSC	0.38±0.02^{cA}	0.58±0.03^{bB}	0.68±0.03^{bC}	0.70±0.03^{cC}
Tyrosine Value (mg/100g)	MSC	10.65±0.42^{A}	11.33±0.29^{A}	12.45±1.45^{A}	14.36±1.45^{B}
	RSC	9.75±0.79^{A}	12.25±1.21^{A}	12.43±1.04^{A}	15.0±1.74^{B}
	SSC	8.63±0.91^{A}	9.93±0.52^{A}	11.03±0.33^{B}	11.86±0.80^{B}

Means bearing different superscripts in a row (upper case letters) and in a column (lower case letters) for a parameter differ significantly (P<0.05).

of market chicken leg and breast muscles during frozen storage. No significant changes in ERV was observed during frozen storage, but there were significant (P<0.05) differences among different sources of samples during the whole frozen storage period. SSC samples had significantly higher (P<0.05) ERV (13.45±0.93 to 15.36 ±0.38 ml) than other two samples (MSC and RSC). Similar findings were reported by Abu-Ruwaida *et al.* (1996) for poultry meat stored at –18ºC.

There was significantly lower (P<0.05) TBA level in SSC samples (0.38–0.70 mg malonaldehyde/kg) compared to that in MSC and RSC samples (0.42–0.81 mg malonaldehyde/kg) indicating better quality of SSC samples. TBA values showed a gradual and significant (P<0.05) increase in all the samples during storage, but were below the threshold level (1–2 mg malonaldehyde/kg) of spoilage. The increase in TBA values during storage might occur due to oxidation of poultry fats rich in unsaturated fatty acids (Hedrick *et al.*, 1994). Abu-Ruwaida *et al.* (1996) also found increase peroxide values in poultry meat with increase in frozen storage (–18ºC) time.

Tyrosine value (TV) is considered as an indicator of proteolysis in meat as it measures the amino acid tyrosine and tryptophan in the non-protein extract of meat (Strange *et al.*, 1977). In the present study of tyrosine value of stored chicken samples showed significant

Table 2: **Changes in microbiological quality in chicken from different sources during frozen storage (–18±1ºC) (Mean ± SE) (Bacterial counts expressed as log CFU/g).**

Parameters	Samples	Storage days			
		0	30	60	90
Total viable counts	MSC	$6.28±0.16^{aA}$	$4.75±0.25^{aB}$	$5.25±0.07^{aB}$	$4.32±0.03^{aB}$
	RSC	$6.35±0.10^{aA}$	$4.44±0.15^{aB}$	$5.06±0.02^{aB}$	$5.96±0.07^{bB}$
	SSC	$3.03±0.16^{bA}$	$2.70±0.26^{bB}$	$2.95±0.06^{bB}$	$1.99±0.07^{cB}$
Coliform counts	MSC	$5.12±0.34^{aA}$	$2.63±0.06^{B}$	$2.60±0.09^{aB}$	$2.46±0.08^{aB}$
	RSC	$4.97±0.33^{aA}$	$2.51±0.09^{B}$	$2.11±0.07^{aC}$	$1.71±0.57^{aD}$
	SSC	$2.35±0.56^{bA}$	$1.44±0.49^{B}$	$1.05±0.06^{bB}$	$0.69±0.40^{bB}$
Psychrophilic counts	MSC	$6.71±0.07^{aA}$	$4.61±0.08^{aB}$	$4.46±0.14^{aB}$	$2.77±0.17^{aC}$
	RSC	$5.63±0.25^{bA}$	$4.44±0.31^{aB}$	$3.74±0.41^{bB}$	$3.43±0.12^{bB}$
	SSC	$2.82±0.11^{cA}$	$2.62±0.09^{bB}$	$2.06±0.14^{cB}$	$1.59±0.53^{bB}$
Yeast & moulds counts	MSC	$2.91±0.22^{aA}$	$2.57±0.10^{aB}$	$2.46±0.10^{B}$	$2.17±0.12^{aB}$
	RSC	$2.71±0.26^{aA}$	$2.40±0.15^{aB}$	$1.57±0.53^{B}$	$1.33±0.13^{aB}$
	SSC	$1.87±0.13^{bA}$	$1.70±0.27^{bB}$	$1.04±0.53^{B}$	$0.58±0.33^{bB}$

Means with different superscripts in a row (upper case letters) and in a column (lower case letters) for a parameter differ significantly (P<0.05).

increase (P<0.05) over a period of 90 days indicating certain degree of proteolysis during frozen storage. Muthulakshmi (2007) reported a similar increase in tyrosine values during frozen storage of buffalo meat sausages at –18ºC for 60 days.

Microbiological study showed a significant decrease (P<0.05) in the population of total bacteria, coliforms, psychrophilic bacteria and yeast and moulds in all types of samples during frozen storage due to death of vegetative form of the microorganisms in meat by thermal shock, ice formation, dehydration (reduced water activity) and high solute concentration (Hedrick *et al.*, 1994, Warriss 2000). Similar decrease in total viable count, coliform count, psychrophilic count, coliform count, yeast sand mould counts were recorded by Abu-Ruwaida *et al*. (1996) and Anand *et al.* (1989) during prolonged storage of broiler chicken at –18ºC. Among the three sample sources, SSC had significantly lower (P<0.05) microbial load due to hygienic processing of SSC broilers.

Results of organoleptic study (Table 3) showed that period of storage as well as sources of samples did not have significant effect on appearance, flavour and texture scores of meats. However, juiciness of MSC samples decreased significantly (P<0.05) from 6.53±0.13 to 5.96±0.11 over a period of 90 days. Both RSC

Table 3: **Changes in organoleptic characteristics of chicken meat during frozen storage (–18±1ºC) (Mean ± SE).**

Parameters	Samples	Storage days			
		0	30	60	90
Appearance	MSC	6.47±0.08	6.41±0.09	6.50±0.10	6.46±0.10
	RSC	6.69±0.09	6.67±0.09	6.67±0.08	6.66±0.10
	SSC	6.58±0.10	6.67±0.11	6.64±0.09	6.71±0.90
Flavour	MSC	6.50±0.09	6.22±0.09	6.28±0.08	6.13±0.13
	RSC	6.72±0.10	6.61±0.11	6.61±0.10	6.21±0.10
	SSC	6.58±0.14	6.58±0.12	6.60±0.13	6.50±0.10
Juiciness	MSC	$6.53{\pm}0.13^{A}$	$6.47{\pm}0.10^{A}$	$6.39{\pm}0.09^{A}$	$5.96{\pm}0.11^{aB}$
	RSC	6.67±0.12	6.78±0.08	6.69±0.13	$6.13{\pm}0.09^{a}$
	SSC	6.61±0.12	6.83±0.11	6.64±0.12	$6.42{\pm}0.10^{b}$
Texture	MSC	6.44±0.11	6.31±0.10	6.19±0.10	6.25±0.09
	RSC	6.68±0.10	6.67±0.11	6.47±0.10	6.46±0.10
	SSC	6.72±0.13	6.69±0.10	6.53±0.10	6.71±0.11
Overall palatability	MSC	$6.53{\pm}0.12^{a}$	$6.33{\pm}0.10^{a}$	6.58±0.08	$6.29{\pm}0.09^{a}$
	RSC	$6.75{\pm}0.09^{a}$	$6.81{\pm}0.07^{b}$	6.69±0.11	$6.50{\pm}0.12^{ab}$
	SSC	$6.89{\pm}0.14^{b}$	$6.90{\pm}0.10^{b}$	6.92±0.13	$6.71{\pm}0.09^{b}$

Means with different superscripts in a row (upper case letters) and in a column (lower case letters) for a parameter differ significantly (P<0.05).

and SSC samples had low juiciness on 90th day of storage but non-significant at 5% level. This decrease in juiciness might be due to slight dehydration (loss of moisture) of the samples during long period of storage. SSC samples maintained significantly (P<0.05) higher overall palatability scores than MSC and RSC samples throughout the storage period although the period of storage as such had no significant bearing on overall palatability scores of the samples. For all the samples organoleptic scores for all the sensory parameters (except juiciness in MSC samples on 90th day of storage) varied from 6.13±0.09 to 6.71±0.09 on 8 point hedonic scale indicating good to very good eating quality of the frozen chicken. This is in agreement with the observations of Abu-Ruwaida *et al.* (1996) and Anand *et al.* (1989) who reported acceptability of chicken meat after 6-9 months of storage at –18ºC.

Overall, the study showed that scientifically slaughtered chicken had better biochemical and microbiological qualities with better overall acceptability than market/road side and retail slaughtered chicken and dressed chicken from all three sources can be stored at –18ºC without any appreciable deterioration in their quality at least for 90 days.

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