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Sodium Tri-Polyphosphate Improves the Storage Stability of Restructured Poultry Meat Slices at Refrigerated (4±1°C) Storage

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ABSTRACT

To evaluate quality changes in restructured turkey meat slices without sodium tri-polyphosphate (T1), with sodium tri-polyphosphate (T2), and chicken slices with sodium tri-polyphosphate (T3), a refrigerated storage study was conducted at 4±1°C. The cooking yield, moisture content, pH, and batter stability were significantly higher in T2. In all three treatments, a consistent increase in TBARS values was observed throughout the storage period. The microbial counts remained within acceptable limits for cooked meat products. Psychrotrophs were not detected during the 30-day storage period. As storage time increased, a gradual decline in overall acceptability was noted. The restructured products remained acceptable up to 20, 25, and 30 days for T1, T2, and T3, respectively. The use of polyphosphates significantly enhanced sensory attributes, slowed lipid oxidation, and extended the shelf life of the restructured meat slices.

Keywords: Turkey, spent hens, polyphosphates, restructured meat slices, refrigerated storage, and quality changes.

INTRODUCTION

Meat serves as the major source of animal protein for mankind. There is variation in the taste, nutritional value, and aesthetic appeal of meat from different animal species. Worldwide consumption of turkey meat is increasing due to its desirable sensory attributes like taste and texture, its moderate levels of total lipids, saturated fatty acids, and cholesterol. These features provide beneficial effects on human health, especially in the prevention of cardiovascular disease (Krauss et al. 2001). Turkey meat contains more protein and less fat. It is a rich source of selenium and B vitamins like niacin and vitamin B_6. Hence, turkey meat is gradually gaining popularity globally and is the second most popular meat in poultry (Baeza et al. 2022). The physicochemical and functional meat quality characteristics of dark and white meat from female Black turkeys, female Beltsville white turkeys, and spent hens revealed that the pH of dark meat was significantly higher than that of white meat in all groups. Turkey meat had significantly higher water-holding capacity compared to broiler spent hens (Kumar et al. 2011).

Turkey meat can be processed into a variety of products like canned turkeys, turkey paste, smoked turkeys, turkey rolls, sticks, pickles, slices, and turkey cocktail sausages. Restructured meat products tend to be leaner and are appropriate for health-conscious consumers (Gadekar et al. 2014). The restructured turkey meat products are one of the processed convenience products that may help popularize turkey meat. Restructuring has the advantage of convenience in preparation, which is why restructured products are becoming increasingly important components of the meat industry. Meat or meat products are highly vulnerable to lipid oxidation, which leads to the rapid development of rancid or warmed-over flavor. Earlier researchers used antioxidants to improve the oxidative stability of restructured goat meat products (Gadekar et al. 2014). The restructured chicken meat blocks extended with sorghum flour and potato were evaluated at refrigerated storage. The product had 15 days shelf life with acceptable physico-chemical, microbiological, and sensory qualities (Malav et al. 2013).

The scientific data on the processing, quality, and shelf life of restructured turkey meat slices made with sodium tripolyphosphate is very limited. Therefore, the study was conducted to assess the storage stability of restructured turkey without sodium tripolyphosphate, as well as turkey and chicken slices containing sodium tripolyphosphate during refrigerated storage.

MATERIALS AND METHODS

Chicken and turkey meat

Spent hens and dressed carcasses of each female Black Turkey and Beltsville Small White Turkey were obtained from ICAR-Central Avian Research Institute, Izatnagar. The turkey and chicken carcasses were manually hot deboned, and separable fat, fascia, and loose connective tissues were carefully trimmed off. Turkey and chicken meat were cut into small cubes and chilled for 12 hours. The dark and white meat were kept separately in LDPE bags in a deep freezer (-18±1°C).

Preparation of restructured turkey and chicken meat slices

The frozen turkey and chicken meat were kept at 4±1°C overnight for thawing. The meat was cut into about 3 cm cubes. The dark and white meat were mixed in the natural proportion (dark meat- 46.8% and white meat- 53.2%) as found in the carcass components. Sodium nitrite (150 ppm), salt (1.8%), sodium tripolyphosphate (0.4% except in T1), and sugar (0.3%) were added to the meat and massaged in an Electrolux Paddle mixer for 2 minutes. After the addition of ice flakes (7.2%), it was further massaged for 2 minutes. The condiments (2.4%) and whole egg liquid (3.5%) were incorporated and massaged for 3 minutes till tacky exudate was formed. The refined wheat flour was added and massaged for the next 3 minutes. Three kg of batter was made for each formulation. The meat batter was filled into aluminum moulds (16½ x 8 x 6 cm). Steam cooking was done for 45 minutes. The core temperature of the product was 92±2 °C. After cooking, the exudate was drained off, and the meat blocks were cooled and kept overnight for chilling (4±1°C). They were cut into slices of 5 mm thickness using a food slicer (Electrolux OMAS). About 250 gm of slices were packed in each of 12 LDPE bags (200-gauge thickness) and kept at refrigerated (4±1°C) storage for further studies.

Analytical procedures

pH was measured using a digital pH meter (Elico, Model LI 127, India). The weight of meat blocks was recorded before and after initial cooking and the yield was calculated (cooking yield = weight of cooked blocks/weight of raw batter x 100) and expressed as a percentage. The procedure of Kondaiah *et al.* (1985) was followed to measure the batter stability. The procedure of Tarladgis *et al.* (1960) was followed to estimate the TBARS number as mg of malonaldehyde per kg of sample.

Texture profile analysis

Texture profile analysis (TPA) of products was carried out by the procedure described earlier (Bourne 1978) using a Stable Microsystems Texturometer (Stable Microsystems Ltd., Surrey, UK) model TA-XT2 texture analyzer attached to software, Texture Expert. Uniform-sized pieces (1.5 cm^3) were used as the test samples. They were placed on a platform in a fixture and compressed to 50% of their original height at a cross-head speed of 50 mm/s through a two-cycle sequence, using a 25 kg load cell.

Microbiological evaluation

All the microbiological parameters of restructured meat slices were determined by the methods described by ICMSF (1996). The plate count agar (M 091) was used for mesophilic counts. Plates were incubated at 37±1 °C for 48 h, and plates showing 30–300 colonies were counted. Potato dextrose agar (M 096) was used to enumerate yeast and mold counts. The plates were incubated at 25±1 °C for 5 days. Black, white, red, or greenish-black-coloured colonies appearing on the plates were counted. Colonies judged to be borderline cases were also counted.

Sensory evaluation

A sensory panel consisting of scientists and postgraduate students of the Division of Livestock Products Technology, ICAR- Indian Veterinary Research Institute, Izatnagar evaluated the sensory attributes viz: appearance, flavour, juiciness, texture, binding, and overall acceptability of restructured meat slices using 8 points descriptive hedonic scale (Keeton 1983) where 8 denoted extremely desirable and 1 denoted extremely poor. The panellists were trained and well-acquainted with different sensory attributes during their postgraduate/doctoral program. They were briefly explained the nature of the experiment without disclosing the identity of the samples. Filtered tap water was provided to the panellists for rinsing their mouths between the evaluation of samples.

Statistical analysis

Three replicate measurements were made and the data generated for different quality characteristics were compiled and analyzed using a randomized block design at the Institute's computer centre. The data were subjected to analysis of variance (one-way ANOVA), least significant difference (Snedecor and Cochran 1995) and Duncan's multiple range test (Steel and Torrie 1981) for comparing the means to find the effects between treatments, storage periods and their interaction for various parameters in different experiments. The smallest difference (D5%) for two means to be significantly different ($P < 0.05$) is reported.

RESULTS AND DISCUSSION

Physiochemical attributes, proximate composition, and texture profile of restructured meat products

The cooking yield was significantly higher ($P<0.01$) in turkey meat slices incorporated with polyphosphate than in chicken meat slices with polyphosphate and turkey meat slices without polyphosphate (Table 1). Young et al. (1992) have reported that phosphates caused increased moisture binding and reduced cooking loss by increasing meat pH. Moreover, Kumar *et al.* (2011) reported that turkey meat had significantly higher water-holding capacity compared to broiler spent hens. The stability of the batter was significantly higher ($P<0.01$) in restructured turkey meat containing polyphosphate than that of chicken meat with polyphosphate and turkey meat without polyphosphate. This shows that turkey meat had better emulsion stability than chicken meat. Prusa and Bowers (1984) reported that turkey meat batters with sodium tri-polyphosphate (with NaCl) had increased batter expansion (greater peak heights) upon heating.

The pH of restructured turkey meat batter was significantly higher ($P<0.01$) than in restructured turkey meat batter without polyphosphate and restructured chicken meat batter with polyphosphates. This was due to the addition of sodium tripolyphosphate during batter making. This finding is in agreement with Lautenschlaeger and Weber (1999), who observed increased pH of meat after polyphosphate addition. The chicken meat had a lower pH than turkey meat, even after adding polyphosphate. The pH of cooked slices of chicken meat was nearly equal to the pH of turkey meat slices without polyphosphate.

Moisture content was higher in restructured turkey meat slices with polyphosphate than in the other two products. This might be due to polyphosphate in it. The moisture content of chicken meat products was higher than that of turkey meat products even after the addition of polyphosphate. Turkey meat might have better moisture retention capacity even during cooking. There was no significant difference in the protein content of the products. However, protein content was higher in turkey meat slices without polyphosphate than in the other two products. This might be due to its lower cooking yield and batter stability. Fat content was significantly higher ($P<0.01$) in chicken meat slices than in the other two products. The chicken meat slices had almost double the amount of fat content. This was due to the higher fat content in chicken meat used for product formulation than in turkey meat. The superiority of turkey meat over chicken meat in terms of functional properties has been reported by Kumar et al. (2011). Energy content was significantly higher ($P<0.01$) in restructured turkey meat slices 5.7 Kcal/g without polyphosphate than in restructured turkey meat slices with polyphosphate (5.30 Kcal/g) and chicken meat slices (5.30 Kcal/g).

Table 1. Physiochemical attributes, proximate composition and texture profile of restructured meat products (Mean ± S.E.)

Parameters	T1	T2	T3
Product yield (%) #	91.51 ± 0.62^{b}	95.25 ± 0.3^{a}	92.55 ± 0.41^{b}
Batter stability (%) #	89.04 ± 0.90^{b}	93.03 ± 0.73^{a}	89.60 ± 1.04^{b}
pH##	5.94 ± 0.02^{b}	6.05 ± 0.02^{a}	5.93 ± 0.01^{b}
Moisture (%) ##	69.36 ± 1.20^{a}	70.2 ± 0.96^{a}	68.17 ± 0.61^{a}
Protein (%)	21.68 ± 0.38^{a}	20.39 ± 0.37^{a}	20.95 ± 0.79^{a}
Fat (%)	2.97 ± 0.48^{b}	3.22 ± 0.22^{b}	6.46 ± 0.05^{a}
Energy (kcal/g)	5.70 ± 0.02^{a}	5.30 ± 0.01^{b}	5.30 ± 0.03^{b}
Texture profile analysis*			
Hardness (N/cm²)	60.31±6.66	51.36±4.65	58.60±7.55
Adhesiveness (Ns)	0.00 ± 0.01^{a}	0.02 ± 0.01^{a}	-0.03 ± 0.01^{b}
Springiness (cm)	0.76 ± 0.01^{b}	0.82 ± 0.01^{a}	0.79 ± 0.01^{ab}
Cohesiveness (Ratio)	0.46 ± 0.03^{b}	0.56 ± 0.01^{a}	0.50 ± 0.02^{ab}
Gumminess (N/cm²)	28.66±2.21	29.78±2.06	28.38±3.33
Chewiness (N/cm)	26.19±1.35	28.31±2.25	28.75±3.45
Fracturability (N)	0.05±0.01	0.02±0.01	0.04±0.01

Means with different superscripts in the same row indicate significant difference ($P<0.05$)

N = 3; #N = 13; ##N = 9, *N = 9

Adhesiveness was significantly higher ($P<0.05$) in turkey meat samples with and without polyphosphate than in chicken meat samples (Table 1). Springiness ($P<0.01$) and cohesiveness ($P<0.05$) were significantly higher in turkey meat products with polyphosphate than those without polyphosphate. The hardness of samples without polyphosphate was moderately higher than that of those with phosphates. The reduction in hardness was explained by the higher moisture content of the slices containing polyphosphates. In comminuted sausages, hardness decreased with an increase in moisture content (Chin et al. 2004). However, parameters like hardness, gumminess, chewiness, and fracturability did not differ significantly ($P>0.05$) between all three products. In the presence of NaCl, the phosphate tended to increase the textural attributes, especially cohesiveness at lower phosphate levels (Young et al. 1987). A significantly lower ($P<0.01$) springiness observed in restructured turkey meat products without polyphosphate as compared to other products might be due to its lower elastic properties resulting from less efficient binding. Sodium phosphate addition has been associated with changes in meat texture, especially when used at higher levels. The meat containing polyphosphate had a more processed meat-like bite (Miller, 1998). A decrease in springiness in shelf-stable pork sausages (Thomas et al. 2008) with a decrease in pH was reported.

Physico-chemical characteristics of restructured meat slices during refrigerated storage

Physico-chemical characteristics of restructured meat slices during refrigerated storage are presented in Table 2.

pH

pH of restructured turkey meat slices with or without polyphosphate and chicken meat slices with polyphosphate did not show any significant differences (P>0.05). But in general, the pH of the restructured turkey slices with polyphosphate was always higher than that of the restructured turkey slices without polyphosphate. This might be due to the addition of phosphate, which leads to a modest rise of 0.1 to 0.3 pH units (Rongrong et al. 2000). The pH of restructured turkey and chicken slices did not vary markedly during the storage period.

Table 2. Effect of refrigeration (4±1^{o}C) storage on physicochemical properties of restructured meat products

Treatment/ Parameter	Storage period (days) 0	5	10	15	20	25	30
pH							
T1	6.26±0.04	6.37±0.11	6.33±0.01	6.35±0.01	6.35±0.01	6.34±0.04	6.29±0.03
T2	6.34±0.03	6.44±0.09	6.39±0.01	6.40±0.02	6.40±0.00	6.38±0.03	6.35±0.01
T3	6.26±0.05	6.38±0.10	6.30±0.02	6.32±0.01	6.31±0.01	6.30±0.05	6.23±0.04
Standard Plate Count (log10 cfu/g)							
T1	2.36±0.31	2.41±0.07	2.37±0.07	2.11±0.25	2.32±0.40	2.45±0.20	3.03±0.42
T2	2.91±0.18^{a}	2.46±0.27^{ab}	2.73±0.33^{a}	1.53±0.07^{b}	2.80±0.12^{a}	2.48±0.25^{ab}	2.57±0.43^{a}
T3	2.43±0.11^{a}	2.48±0.12^{a}	2.60±0.36^{a}	1.85±0.26^{a}	1.98±0.46^{a}	3.54±0.13^{b}	2.77±0.28^{a}
Yeast and Mould (log10 cfu/g)							
T1	0.88±0.56	1.78±0.4	1.38±0.21	1.14±0.62	1.25±0.63	1.77±0.4	2.13±0.27
T2	0.81±0.51	1.02±0.7	1.29±0.59	1.13±0.43	1.05±0.73	2.02±0.27	1.64±0.33
T3	1.29±0.32	1.86±0.24	0.89±0.89	1.47±0.43	1.49±0.79	2.02±0.38	1.84±0.33

n=9; Means with different superscripts (small letters in the same row and capital letters in the same column) indicate a significant difference (P< 0.05); T1: restructured turkey meat slices without polyphosphates; T2: restructured turkey meat slices with polyphosphate, and T3: restructured chicken meat slices with polyphosphates.

TBARS number

A steady increase in the TBARS value was noticed in all three products during the entire storage period (Fig 1). The TBARS values were significantly higher (P<0.01) on the 25th and 30th day, and almost doubled in the T1 product. The increase in TBARS value might be due to an increase in fat oxidation. Throughout the storage period, there was no significant difference (P>0.05) in the TBARS value of turkey meat slices containing polyphosphate and chicken meat slices with polyphosphate. The TBARS values of products containing polyphosphate did not vary significantly during storage.

Phosphates tie up free metal ions (Fe and Cu) that are inherently present in meat. The antioxidant activity of polyphosphates has been reported by various workers (Tims and Watt, 1958; Gadekar et al. 2008). Incorporation of phosphates protected cooked meat from auto-oxidation (Tims and Watts, 1958) and lowered TBA values in cooked ground beef stored at 2^{0}C (Sato and Hegarty, 1971). TBA values > 1.0 are usually associated with the perception of rancid flavor (Tarladgis et al. 1960). The TBARS values showed an increasing trend in chicken patties (Kalaikannan et al. 2007). In the present study, no off-flavour was detected as the TBARS values were very well below the acceptable limit in all products, and no rancid flavour was detected by the panelists.

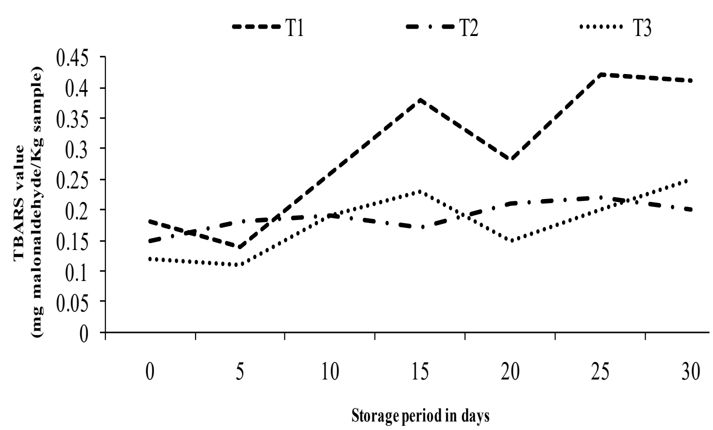

Fig. 1: Effect of refrigerated storage on TBARS values of restructured meat slices

T1: Restructured turkey meat slices without sodium tri-polyphosphate

T2: Restructured turkey meat slices with sodium tri-polyphosphate

T3: Restructured chicken slices with sodium tri-polyphosphate

Microbiological characteristics

The microbial count observed in all three products during refrigerated storage was too low to be categorized as satisfactory and within acceptable limits for cooked meat products (Table 2). The total viable count showed an increasing trend with the advancement of the storage period. In restructured beef roasts, cooking lowered the aerobic plate count to an almost undetectable level in the cooked product (Smith et al. 1990). The aerobic plate count of restructured buffalo rolls containing sodium tripolyphosphate (0.3%) was around 2.93 log_{10} cfu/gm (Mendiratta et al. 2002). In pre-cooked roast beef containing 0.4% level of sodium tripolyphosphate, the level of mesophiles was 2.93 during refrigerated storage (Cheng and Ockerman, 2003). Total plate count of cooked sausages prepared from broiler (4.37 log_{10} CFU/gm) and spent hen (4.58 log_{10} CFU/gm) meat on the 21st day of refrigerated storage (Bhattacharyya et al. 2007). Turkey meat with a higher pH is more conducive to microbial growth, especially those microorganisms involved in meat spoilage, either aerobic or anaerobic (Miller, 1998).

Psychrotrophs were not detected throughout the storage period of 30 days. Absence of psychrotrophs might be due to the retardation of the log phase as a result of reduced metabolic rate due to sudden changes in the physical environment. It could also be due to the thorough cooking of the product during processing, which drastically injured and killed psychrotrophs in the restructured slices (Jay 1996). The absence of psychrotrophs has been reported in aerobic as well as vacuum-packaged chicken patties during refrigerated and frozen storage (Singh et al. 2002).

Yeast and mould growth were detected throughout the storage period but there was no significant increase (P>0.05) in all three products during the storage period of 30 days. Also, there was no significant difference (P>0.05) in yeast and mould counts among products. In restructured buffalo meat rolls containing sodium tripolyphosphate, the yeast and mould counts were 1.81 log_{10} cfu/gm (Mendiratta et al. 2002). Throughout the storage period, the counts for mesophilic, psychrotrophic, and coliforms were well below the levels, i.e., $log_{10}7$ cfu/g, $log_{10}4$ cfu/g, and $log_{10}3$cfu/g, respectively (Jay 1996), that could cause microbiological spoilage of the product.

Sensory attributes

Appearance of the three products got progressively decreasing scores over the storage period of 30 days (Table 3). On days 25 and 30, the restructured turkey meat slices without polyphosphate had significantly lower (P<0.01) scores than restructured turkey and chicken meat slices with polyphosphates. This might be due to the effect of sodium tri-polyphosphate on the product, as added polyphosphate improves colour (Ahn et al. 1981). Restructured chicken slices were rated slightly lower for appearance on day zero. The flavour of all three products was found to be very good on the zero day. As the storage period increased, restructured turkey meat slices without polyphosphate were rated with lower scores than the other two products. Chicken meat slices were found more acceptable to the sensory panel from day 10 onwards, but no significant differences (P>0.05) were found between them. Polyphosphate-treated turkey and chicken meat slices were rated better for flavour than T1 during the entire period of storage. This is probably due to the effect of sodium tripolyphosphate on the product, which delays the onset of lipid oxidation (Feiner, 2006).

There was a decrease in juiciness during storage. In case of restructured turkey slices without polyphosphate, the juiciness decreased significantly (P<0.01) from the 20th day onwards, whereas in the other two products, it decreased significantly (P<0.01) only on the 30th day of storage. This might be due to the addition of polyphosphate, which increases water-holding capacity, quality, and consumer acceptance of meat products (Miller, 1998). Improvement in sensory properties of *shami kebabs* due to polyphosphate treatment has been reported (Agnihotri, 2004).

Table 3. Effect of refrigerated (4±1°C) storage on sensory attributes of restructured meat products

Treatment/ Parameter	Storage period (days) 0	5	10	15	20	25	30
				Appearance			
T1	$7.19±0.09^{a}$	$6.95±0.07^{a}$	$6.76±0.09^{b}$	$6.69±0.11^{b}$	$6.64±0.10^{b}$	$5.90±0.13^{cB}$	$6.07±0.12^{cB}$
T2	$7.19±0.09^{a}$	$7.02±0.09^{a}$	$7.05±0.03^{a}$	$6.93±0.07^{a}$	$6.67±014^{b}$	$6.88±0.05^{aA}$	$6.64±0.09^{bA}$
T3	$6.98±0.11^{a}$	$6.97±0.12^{a}$	$6.81±0.05^{ab}$	$6.86±0.09^{ab}$	$6.57±0.13^{b}$	$6.95±0.03^{aA}$	$6.64±0.44^{bA}$
				Flavour			
T1	$7.06±0.09^{a}$	$6.67±0.11^{b}$	$6.69±0.09^{ab}$	$6.12±0.10^{c}$	$6.02±0.09^{cB}$	$5.74±0.09^{cB}$	$5.33±0.12^{dB}$
T2	$7.04±0.09^{a}$	$7.04±0.09^{a}$	$6.77±0.05^{ab}$	$6.40±0.14^{bc}$	$6.52±0.14^{bA}$	$6.74±0.07^{abA}$	$6.08±0.11^{cA}$
T3	$6.95±0.11^{a}$	$6.88±0.12^{a}$	$6.92±0.03^{a}$	$6.82±0.09^{ab}$	$6.67±0.16^{abA}$	$7.00±0.08^{aA}$	$6.45±0.14^{bA}$
				Juiciness			
T1	$6.82±0.07^{a}$	$6.64±0.12^{aaB}$	$6.74±0.10^{ab}$	$6.69±0.10^{a}$	$6.57±0.14^{abA}$	$6.40±0.08^{bA}$	$5.55±0.16^{cA}$
T2	$6.96±0.08^{a}$	$7.10±0.09^{aA}$	$6.80±0.05^{a}$	$6.77±0.08^{a}$	$6.98±0.16^{aB}$	$6.74±0.09^{aAB}$	$6.36±0.09^{bB}$

T3	6.87±0.15^{a}	7.01±0.10^{aaB}	7.00±0.00^{a}	6.93±0.04^{a}	6.86±0.10^{aAB}	6.95±0.03^{aB}	6.64±0.10^{bB}
				Texture			
T1	6.89±0.11^{a}	6.81±0.10^{a}	6.92±0.07^{a}	6.77±0.09^{a}	6.15±0.14^{bB}	6.81±0.07^{a}	5.93±0.15^{bA}
T2	7.08±0.09^{a}	7.1±0.10^{a}	6.92±0.06^{a}	6.90±0.04^{ab}	6.60±0.16^{bcA}	6.88±0.05ab	6.45±0.09^{cB}
T3	7.02±0.11^{a}	6.90±0.08^{ab}	7.00±0.02^{a}	6.94±0.03^{a}	6.62±0.12^{bA}	6.90±0.04^{ab}	6.60±0.10^{bB}
				Binding			
T1	7.01±0.08^{a}	6.95±0.07^{a}	7.02±0.02^{a}	6.88±0.06^{a}	6.40±0.15^{b}	6.98±0.02^{a}	6.26±0.11^{bB}
T2	7.06±0.08^{a}	7.04±0.08^{a}	6.95±0.06^{a}	6.98±0.02^{a}	6.38±0.14^{b}	6.88±0.05^{a}	6.57±0.11^{bA}
T3	7.02±0.08^{a}	6.98±0.02^{a}	6.98±0.04^{a}	7.00±0.00^{a}	6.62±0.12^{b}	6.95±0.03^{a}	6.83±0.07^{abA}
				Overall Palatability			
T1	6.95±0.09^{a}	6.67±0.12^{acB}	6.68±0.07^{acB}	6.25±0.07^{bcdB}	6.38±0.09^{cB}	5.98±0.06^{dB}	5.52±0.14^{eB}
T2	7.14±0.08^{a}	7.12±0.10^{aA}	6.95±0.07^{acAB}	6.61±0.14^{bdA}	6.81±0.06^{cA}	6.83±0.05^{abcA}	6.38±0.07^{dA}
T3	6.92±0.10^{a}	6.89±0.08^{aAB}	7.06±0.05^{abA}	6.93±0.08^{aA}	6.77±0.06^{abA}	6.90±0.04^{aA}	6.55±0.10^{bA}

n=21 * Based on an 8-point descriptive scale (8 = extremely desirable; 1 extremely undesirable). Means with different superscripts (small letters in the same row and capital letters in the same column) indicate a significant difference (P<0.05)

A significant reduction (P<0.01) in the texture scores was observed towards the latter part of the storage period. Phosphate-incorporated products had significantly higher (P<0.01) texture scores than T1 on the 20th and 30th day of storage. Chicken patties containing sodium tripolyphosphate had improved textural attributes (Young et al. 1992). Significantly lower (P<0.01) binding was observed on the 20th and 30th day of the storage period in all three products. Binding was significantly better (P<0.01) in restructured turkey and chicken meat slices with polyphosphate in comparison to T1. The use of polyphosphate in combination with salt might have enhanced the myofibrillar protein extractability and a subsequent increase in binding (Rongrong et al. 2000; Feiner 2006).

With the advancement in the storage period, a gradual decreasing trend was observed in the overall acceptability of the products. The decrease was rapid in T1 restructured turkey meat slices, less slow in restructured turkey meat slices with polyphosphate (T2), and still lower in restructured chicken meat slices with polyphosphates (T3). There was a significant decrease (P<0.01) in the overall palatability of restructured turkey meat slices without polyphosphate in comparison to other products from day 5th onwards. This might be attributed to their substantial decrease in flavour, juiciness, and texture with the increase in storage period.

CONCLUSIONS

The use of polyphosphates significantly improved the sensory attributes, slowed down lipid oxidation, and improved the shelf life of the restructured slices. Comparison of turkey and chicken meat slices with polyphosphate showed a mixed response, and no significant differences were found, but on 25 and 30th day of storage, chicken meat slices scored slightly better than turkey meat slices containing polyphosphate. The restructured turkey slices without polyphosphate (T1) were acceptable for 20 days, and turkey and chicken slices containing polyphosphates were acceptable for up to 25 and 30 days, respectively, at refrigerated (4±1°C) storage.

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