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Research Paper

Efficacy of Curry Leaf Powder and Tomato Paste on Storage Stability of Chicken Meat Patties

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ABSTRACT

A study was conducted to investigate the effect natural antioxidants i.e. of curry leaf powder and tomato paste comparing with synthetic antioxidant (butylated hydroxyl anisole) on the quality and storage stability of chicken meat patties added with 5 per cent oat flour at refrigeration (4±1°C) temperature. Storage studies revealed a significant ($p<0.05$) effect on the physico-chemical, microbiological and sensory quality of chicken meat patties due to the incorporation of various antioxidants during refrigeration. Chicken meat patties incorporated with tomato paste at 5 per cent level had significantly ($p<0.05$) lower values for cooking loss, pH, standard plate count and yeast and mould count and significantly ($p<0.05$) higher values for various attributes of sensory evaluation under refrigerated storage. Chicken meat patties added with curry leaf powder at 1 per cent level had significantly ($p<0.05$) lower values for 2-TBARS than control and other treatments. A significant ($p<0.05$) increase in cooking loss, pH and 2-TBARS value and a decrease in emulsion stability, WHC of chicken meat patties was observed as refrigeration storage period progressed. Psychrophilic and Coliforms were not detected in any of the treatments and control sample during storage. It is concluded that tomato paste at 5 per cent level exerted significantly ($p<0.05$) desirable effect on quality characteristics of chicken meat patties and protected its quality with a higher degree of acceptability.

Keywords : *Lipid oxidation, Oat flour, Curry leaf power, Tomato paste, Storage stability*

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INTRODUCTION

Lipid oxidation is the major quality deteriorative process in meat and meat products resulting in a variety of breakdown products which produce off-odours and flavours. The inhibition of oxidation process is very important in meat products. Antioxidants can delay or inhibit the oxidation propagation of oxidizing chain reactions in the oxidation process and considered as important nutraceuticals because of many health benefits (Valko *et al*. 2007).

The meat industry is searching for natural solutions to minimize oxidative rancidity and extend the shelf-life of meat products than addition of various synthetic agents, such as butylated hydroxyl anisole (BHA), butylated hydroxyl toluene (BHT) and propyl gallate (PG). The synthetic antioxidants currently used have been found to exhibit various negative health effects in animals and primates (Saito *et al.* 2003). Thus, the research for natural methods to retard oxidative processes in meat has led to utilization of natural antioxidants. The antioxidant activity of extracts from various plant species have been recognised in grains, oil seeds, spices, honey, fruits and vegetables (Naveena *et al*. 2007) and a number of extracts have been evaluated (Bastida *et al.* 2009; Bhaskar Reddy *et al.* 2013). Due to concerns about toxicological safety of synthetic antioxidants such as BHA and BHT, naturally derived antioxidants are perceived as better as and safer than synthetics.

Curry leaf (*Murraya koenijii*) is a spice characterizing authentic Asian-Indian cuisine and it is used in small quantities for its distinct aroma as well as for preservation purposes. Interest in greater use of curry leaf has been stimulated antioxidant potency. The antioxidant activity is attributed to alkaloids such as mahanimbine, murrayanol and mahanine from *M. koenigii* (Tachibana *et al*. 2003; Ningappa *et al.* 2008). These alkaloids also shown to have antimicrobial activity against bacteria and fungi (Chowdhury *et al*. 2001).

In tomatoes the principal carotenoid is lycopene with amounts of â- carotene. Lycopene, is a powerful quencher of singlet oxygen (Farombi 2004).Tomato is also a rich source of minerals (iron and phosphorus), vitamins (A and C), organic acids, essential amino acids and dietary fiber. Tomatoes, with their abundant lycopene, may defend against cancer by protecting DNA from oxidative damage and reduce prostate cancer. Lycopene exhibits the highest antioxidant activity which may contribute to a reduction in disease risk.

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Many natural plant extracts contain primarily phenolic compounds, which are potent antioxidants (Wong *et al*. 1995). Consumers are increasingly interested about health oriented functional meat products. It has not only in consumer, but also among researchers and meat food product processors to develop formulated products, which are "natural, functional and nutritional" as well. Functional meat products either possess nutritional ingredients that improve health or contain lesser quantity of harmful compounds like cholesterol, fat etc., (Yue 2001; Diplock *et al.* 1999). These products are generally produced by reformulation of meat by incorporating health producing ingredients like variety of fibers, protein, polyunsaturated fatty acids (PUFA), antioxidants etc. With this background, the present research work has been designed to investigate the anti-oxidative effect of curry leaf powder and tomato paste on storage stability of chicken meat patties added with 5 per cent oat flour during refrigerated (4± 1^0C) storage.

MATERIALS AND METHODS

The natural antioxidants i.e. curry leaf powder (*Murraya koenigii*) at 1 per cent (T1), tomato paste (Lycopersicum esculentum) at 5 per cent (T2) and Butylated Hydroxy Anisole (BHA) at 0.01per cent (T3) levels were added separately to the pre-standardized 5 per cent oat flour added chicken meat patties. These antioxidant treated samples along with control were stored at refrigeration (4±1°C) temperature and analyzed at 0, 3, 5, 7, 9 and 11^{th} day.

Source of ingredients

Chicken: After trimming the excess fat, tendons and separable connective tissue, boneless chicken was packaged in LDPE pouches and stored at refrigeration temperature (4±1°C) for further product formulation.

Spices, condiments and oat flour: Spice mix was prepared utilizing aniseed, black pepper, capsicum, caraway seed, cardamom, cinnamon, clove, coriander, cumin seed, nutmeg, turmeric and small cardamom at 12, 8, 11, 8, 5, 5, 2, 20, 20, 3, 5 and 1%, respectively. Condiment paste was made from onion, ginger, and garlic in the ratio of 3:1:1.

Preparation of curry leaf powder: Fresh matured leaves of *M. koenigii* plant from Institute campus were collected and sundried after removal of extraneous matter. The leaves were kept in oven at 50°C for 2 hrs and then ground mechanically and sieved through a fine mesh (U.S.S. 30 # mesh screen). The curry leaf powder was stored in a glass bottle for further use.

Preparation of tomato paste: Fresh and ripened tomatoes were put in boiling water for 3-4 minutes. Then cooled and peeled off their skin and blend in a blender to a smooth puree. The puree obtained was concentrated in a rotary evaporator for 20 minutes at 80^oC and the paste thus obtained was used as "antioxidant base" in the study.

Preparation of chicken meat patties: The chicken meat patties was prepared by mincing the boneless chicken meat in meat mincer (Sirman), then adding salt, ice flakes then chop the meat in a Bowl chopper (Scharfen) for 1 min, add fat again chop the minced meat about 1 min, adding spices, condiments and oat flour @ 5 % and chop for about 2 minutes for emulsion making. During chopping, the emulsion was maintained at 10-12°C by addition of crushed ice. Then the emulsion was divided into four lots and one lot kept as control, remaining three lots adding curry leaf powder @ 1 per cent for T1, tomato paste @5 per cent as T2 and BHA @ 0.01 per cent as T3. The emulsion was then molded in the form of patties (1.2 cm thick, 4.4 cm diameter circular shaped patties and weight 23 g with a patty molder) and packed in LDPE pouches and stored at refrigerated (4±1ºC) temperature and evaluate the storage stability of chicken patties at regular intervals of 0, 3, 5, 7, 9 and 11^{th} days.

Evaluation of quality characteristics

i) Physico-chemical characteristics

a) Cooking loss: Cooking loss was estimated by recording the difference between the pre and post cooking weights of meat patties and expressed as percentage.

b) Water holding capacity: The water-holding capacity of the emulsion was determined by following the procedure of Weirbicki *et al.* (1962). 25 grams of emulsion mix was blended with 75ml of distilled water for 90 seconds in a high speed blender. 35 ml of the meat slurry was centrifuged at room temperature at 1000 rpm for 15 minutes. After centrifugation the volume of supernatant liquid was collected in a graduated cylinder.

c) pH: pH of the preparation was estimated by following the method of Trout *et al.* (1992) using digital pH meter (Oakton Instruments, USA).

d) Thiobarbituric acid reactive substance (TBARS) value: The distillation method outlined by Tarladgis *et al.* (1960) was followed for the determination of TBARS values.

ii) Microbial quality: The microbial quality of samples were evaluated by estimating the total plate count (TPC), psychrophilic count (PPC), coliform counts and yeast and mould counts following pour plating technique as per standard procedure of ICMSF (1980).

iii) Sensory Evaluation: The chicken meat patties thus prepared as per the standardized formulations were microwave cooked for 6 minutes and subjected to sensory panel including staff and students for sensory evaluation to evaluate color, appearance, flavor, juiciness, tenderness and overall acceptability on a 9 point hedonic scale.

Statistical Analysis: The data thus obtained was subjected to statistical analysis using SPSS MAC, version 20.0, SPSS Chicago (US).

RESULTS AND DISCUSSION

Physico-chemical characteristics

Cooking loss: The overall mean per cent cooking loss was significantly lower ($p<0.05$) for chicken meat patties added with tomato paste (T2) than control, T1 and T3. Cooking loss per cent was not affected by addition of curry leaf powder in chicken meat patties. The per cent cooking loss of chicken meat patties increased significantly ($p<0.05$) in control and all treatments during storage. This might be due to lowering of water binding capacity and loss of moisture during storage. These results were in agreement with Das *et al.* (2011) in antioxidant effect of curry leaf powder on quality of ground and cooked goat meat and Nagamallika *et al.* (2006) in refrigerated and frozen chicken patties.

Table 1: Physico-chemical characteristics of chicken meat patties as influenced by antioxidants during refrigerated (4±1°C) storage

Days of storage	0	3	5	7	9	11	Overall Mean
			Cooking loss (per cent)				
	6.17±0.05	8.5±0.01	11.92±0.02	13.77±0.01	18.2±0.01	20.13±0.01	13.11±0.02^{A}
	6.06±0.01	8.32±0.01	11.89±0.01	13.68±0.01	18.04±0.02	20.01±0.01	13.0±0.01^{A}
	5.4±0.01	8.04±0.01	10.66±0.01	12.96±0.01	16.91±0.01	18.71±0.01	12.11±0.01^{B}
	6.21±0.01	9.12±0.01	12.73±0.02	13.9±0.01	18.93±0.01	20.15±0.03	13.50±0.01^{C}
Overall mean	5.96±0.02^{a}	8.49±0.01^{b}	11.8±0.01^{c}	13.57±0.01^{d}	18.02±0.01^{e}	19.75±0.01^{f}	
			Water-holding capacity (percent)				
C	67.33±0.01	62.82±0.01	60.96±0.21	58.73±0.34	56.20±0.25	54.40±0.1	60.07±0.15^{A}
T1	67.83±0.01	62.63±0.07	60.87±0.18	58.73±0.34	56.87±0.46	54.42±0.09	60.22±0.2^{A}
T2	68.91±0.01	63.92±0.19	61.73±0.24	59.82±0.37	57.96±0.47	55.60±0.14	61.32±0.23^{B}
T3	67.44±0.01	62.81±0.004	60.82±0.22	58.80±0.32	56.94±0.48	54.47±0.23	60.21±0.2^{A}
Overall mean	67.87±0.01^{f}	63.04±0.06^{e}	61.09±0.2^{d}	59.02±0.34^{c}	57.0±0.4^{b}	54.72±0.14^{a}	
			pH				
C	5.96±0.19	6.17±0.17	6.22±0.08	6.27±0.03	6.37±0.04	6.49±0.05	6.24±0.09^{A}
T1	5.94±0.21	6.15±0.08	6.19±0.06	6.24±0.02	6.34±0.02	6.48±0.02	6.22±0.07^{A}
T2	5.81±0.19	5.79±0.14	5.73±0.12	5.92±0.18	6.1±0.010	6.32±0.06	5.94±0.1^{B}
T3	5.96±0.19	6.1±0.04	6.18±0.02	6.23±0.01	6.31±0.03	6.44±0.01	6.20±0.05^{A}
Overall mean	5.91±0.19^{a}	6.05±0.1^{b}	6.08±0.07^{c}	6.16±0.06^{d}	6.28±0.02^{e}	6.43±0.03^{f}	
			2-TBARS value (mg malonaldehyde/kg of meat)				
C	0.16±0.01	0.48±0.01	0.97±0.01	1.42±0.01	3.15±0.02	4.02±0.04	1.7±0.01^{A}
T1	0.14±0.01	0.17±0.02	0.34±0.01	0.57±0.01	0.91±0.01	1.1±0.12	0.53±0.03^{B}
T2	0.15±0.01	0.23±0.01	0.43±0.01	0.65±0.02	1.06±0.01	1.37±0.05	0.64±0.01^{C}
T3	0.16±0.01	0.29±0.02	0.53±0.01	0.75±0.02	1.67±0.01	2.00±0.04	0.90±0.01^{D}
Overall mean	0.15±0.01^{a}	0.29±0.01^{b}	0.57±0.01^{c}	0.84±0.01^{d}	1.7±0.01^{e}	2.12±0.06^{f}	

Means bearing at least one common superscript in the same row and in the same column do not differ significantly ($p>0.05$)

C: Control chicken meat patties; **T1:** Chicken meat patties added with 1 percent curry leaf powder (CLP); **T2:** Chicken meat patties added with 5 percent tomato paste (TP); **T3**: Chicken meat patties added with 0.01 percent Butylated Hydroxy Anisole (BHA)

Water-holding capacity: The water-holding capacity was significantly ($p<0.05$) higher for chicken meat patties added with tomato paste (T2) compared to other treatments. The water-holding capacity of chicken meat patties decreased significantly ($p<0.05$) with increased storage period in control and all treatments. This might be due to decreased ability of tissues to save its water due to protein denaturation which lower the hydration capacity of proteins. This can also be attributed to the loosening up of the microstructure of muscles allowing more water to be entrained (Hamm 1960). These results were in agreement with Kim *et al.* (2011) in refrigerated low-fat pork sausages with tomato powder and Das *et al.* (2011) in antioxidant effect of curry leaf powder on quality of goat meat.

pH: The pH values of chicken meat patties added with tomato paste (T3) had significantly ($p<0.05$) lower values than control and other treatments. This might be due to the growth of lactic bacteria. It was observed that the pH increased significantly ($p<0.05$) during refrigerated storage for 11 days which might be due to the accumulation of metabolites by bacterial action. In addition to this protein and amino acid degradation resulting in formation of ammonia might have lead to consequent increase in pH. The results were in agreement with Biswas *et al*. (2006) in chicken patties and *et al.* (2011) in refrigerated low-fat pork sausages with tomato powder.

Thiobarbituric acid reactive substance (2-TBARS) Value: In the present study, the overall mean TBARS values of chicken meat patties with curry leaf powder at 1 per cent level (T1) was significantly ($p<0.05$) lower than the control and other treatments during refrigeration storage. This might be due to mahanimbine, murrayanol and mahaninecarbazole alkaloids from *M .koenigii* (Tachibana *et al.* 2003). A significant ($p<0.05$) increase in the overall mean TBARS values of control and all treatments observed during storage period. This might be due to auto-oxidation of lipids over a period of low temperature storage and pro-oxidant nature of added salt. The results were in accordance with Tachibana *et al.* (2003) in comparison between anti-oxidative properties of carbazole alkaloids from *Murraya koenigii* leaves, Kim *et al.* (2011) in refrigerated low-fat pork sausages with tomato powder and Bhaskar Reddy *et al.* (2013) in restructured mutton slices extended with grape seed extract stored at refrigerated storage.

Microbial quality

Total plate count: A significant difference ($p<0.05$) in total plate count was observed between antioxidant treatments and between storage periods. Among the treatments, chicken meat patties incorporated with tomato paste at 5 % level (T2) showed significantly ($p<0.05$) lower counts than other treatments which might be due to the lower pH and antimicrobial activity of tomato paste.

Table 2: Microbial characteristics of chicken meat patties as influenced by antioxidants during refrigerated (4±1°C) storage

Days	0	3	5	7	9	11	Overall
				Total plate count (log_{10}cfu/g)			
C	4.66±0.05	5.23±0.02	5.52±0.04	5.82±0.01	6.83±0.02	6.93±0.01	$5.7±0.02^{A}$
T1	4.58±0.01	5.01±0.02	5.24±0.04	5.34±0.01	5.76±0.01	5.93±0.01	$5.31±0.02^{B}$
T2	4.07±0.01	3.21±0.10	3.79±0.16	4.09±0.04	5.72±0.01	5.77±0.02	$4.44±0.05^{C}$
T3	4.56±0.01	5.14±0.01	5.53±0.03	5.89±0.19	5.91±0.05	6.13±0.01	$5.52±0.05^{D}$
Overall	$4.46±0.02^{a}$	$4.64±0.03^{b}$	$5.02±0.06^{c}$	$5.3±0.06^{d}$	$6.05±0.02^{e}$	$6.19±0.01^{f}$	
				Yeast and mould count (log_{10}cfu/g)			
C	2.46±0.07	2.66±0.04	2.97±0.05	3.16±0.04	4.06±0.08	5.33±0.05	$3.44±0.05^{A}$
T1	2.43±0.02	2.60±0.03	2.84±0.06	3.21±0.07	3.92±0.07	5.09±0.04	$3.35±0.05^{A}$
T2	2.41±0.03	2.51±0.03	2.82±0.04	3.16±0.04	3.91±0.05	4.90±0.15	$3.28±0.06^{B}$
T3	2.45±0.06	2.53±0.04	2.91±0.05	3.41±0.12	3.95±0.05	5.1±0.03	$3.40±0.06^{A}$
Overall	$2.43±0.04^{a}$	$2.58±0.03^{b}$	$2.90±0.05^{c}$	$3.23±0.06^{d}$	$3.97±0.06^{e}$	$5.15±0.07^{f}$	

Means bearing at least one common superscript in the same row and in the same column do not differ significantly ($p>0.05$)

C: Control chicken meat patties; **T1:** Chicken meat patties added with 1 percent curry leaf powder (CLP); **T2:** Chicken meat patties added with 5 percent tomato paste (TP); **T3**: Chicken meat patties added with 0.01 percent Butylated Hydroxy Anisole (BHA)

The overall mean bacterial count decreased up to day 5 but significantly ($p<0.05$) increased counts were observed with increase in storage period during refrigeration. This might be due to the permissive temperature and relative availability of moisture and nutrients for the growth of mesophilic bacteria. The results were in accordance with Bhaskar Reddy *et al.* (2013) and Kim *et al.* (2013).

Psychrophilic counts: Psychrophiles could not be detected in any of the treatments and control during refrigerated storage. This might be due to the temperature variance for growth of psychrophilic bacteria. The results were in agreement with Biswas *et al*. (2004) in enrobed precooked pork patties under chilled and frozen storage conditions.

Yeast and mould counts: Among the treatments chicken meat patties added with tomato paste at 5 per cent level (T2) showed significantly ($p<0.05$) lower yeast and mould counts than the other treatments which might be due to the lower pH and antimicrobial activity of tomato paste. The overall mean yeast and mould count decreased up to 5 day but significantly ($p<0.05$) increased counts were observed with increase in storage period during refrigeration. These results were in accordance with Rajnish *et al.* (2008) in spent hen meat patties.

Coli form counts: Coli forms were not detected in any of the treatments and control during refrigerated storage. These bacteria are indicator of fecal contamination. Absence of these microorganisms indicated no contamination during post processing handling of chicken meat patties. Similar observations were also recorded by Kim *et al.* (2013) in cooked pork patties.

Sensory quality

Colour: Colour scores of chicken meat patties for control, T1, T2 and T3were 6.81 ± 0.18, 6.871 ± 0.2, 6.82 ± 0.2 and 6.80 ± 0.3 respectively and the analysis of variance revealed that, there was no significant difference ($p<0.05$) among the treatments and control. The colour scores of control and other treatments decreased significantly ($p<0.05$) in refrigerated storage. The reduction in colour scores during storage might be due to free radicals formed in lipid oxidation process can oxidize heme pigments to met-myoglobin which causes the discoloration of product during storage, oxidative fading and moisture loss. Kim *et al.* (2011) in refrigerated low-fat pork sausages with tomato powder and Das *et al*. (2011) in ground and cooked goat meat added with curry leaf powder.

Flavour: The flavour scores of control was significantly ($p<0.05$) lower than all other treatments and T1 sample secured significantly ($p<0.05$) higher flavour scores than the other treatments in refrigerated storage. Flavor scores decreased significantly ($p<0.05$) during refrigeration storage. This might be due to the overall reduction in the quantum of volatile flavour components and due to fat oxidation during storage. The results were in agreement with Das *et al*. (2011) in ground and cooked goat meat.

Juiciness: The juiciness scores were significantly ($p<0.05$) higher in chicken meat patties added 5 % tomato paste (T2) than other treatments. The juiciness scores significantly ($p<0.05$) decreased with increased storage period. Evaporative losses leading to decline in moisture content might be responsible for the above result. Similar findings were noticed by Hoe *et al*. (2006) in quality characteristics of low-fat emulsified sausage containing tomatoes during cold storage, Reddy (2008) in refrigerated spent hen meat nuggets and Kim *et al.* (2011) in refrigerated low-fat pork sausages with tomato powder.

Tenderness: The tenderness scores of chicken meat patties treated with 5 per cent tomato paste (T2) was higher than the other treatments during refrigerated storage. The tenderness scores decreased significantly ($p<0.05$) during storage period. This might be due to the relative reduction in moisture and juiciness of the product that led to hardening of the product. The results were in agreement with Reddy (2008) in refrigerated spent hen meat nuggets and Kim *et al.* (2013) in efficacy of tomato powder as antioxidant in pork patties.

Overall acceptability: The overall acceptability scores for control was significantly ($p<0.05$) lower than all other treatments and chicken meat patties added with tomato paste at 5 % level (T2) scored higher than all other treatments during refrigerated storage. The overall mean acceptability scores decreased significantly ($p<0.05$) with increase in refrigerated storage periods. This might be due to the lowering scores of colour, flavour, juiciness and tenderness of the products during storage. Similar trend in overall acceptability scores during storage was reported by Kim *et al.* (2013) in cooked pork patties.

CONCLUSION

Considering the results obtained in this study, it may be concluded that addition of oat flour and tomato paste at 5 % levels each protect the chicken meat patties against oxidative rancidity but also had higher acceptability and lower microbial counts than addition of 1 % curry leaf powder and BHA up to 11 days during refrigerated (4 ± 1°C) storage.

Table 3: Sensory characteristics of chicken meat patties as influenced by antioxidants during refrigerated (4±1°C) storage

Days of storage	0	3	5	7	9	11	Overall Mean
			Colour				
C	7.81±0.27	7.51±0.24	7.1±0.20	6.75±0.12	6.05±0.05	5.66±0.21	$6.81±0.18^{A}$
	7.83±0.40	7.5±0.34	7.13±0.13	6.81±0.11	6.13±0.07	5.83±0.16	$6.87±0.2^{A}$
2	7.83±0.40	7.5±0.34	7.13±0.13	6.61±0.11	6.04±0.07	5.83±0.16	$6.82±0.2^{A}$
T3	7.83±0.30	7.48±0.40	7.12±0.09	6.68±0.25	6.16±0.11	5.50±0.22	$6.80±0.3^{A}$
Overall mean	$7.82±0.34^{f}$	$7.5±0.33^{e}$	$7.12±0.14^{d}$	$6.71±0.15^{c}$	$6.10±0.07^{b}$	$5.7±0.19^{a}$	
			Flavor				
C	7.83±0.11	7.71±0.07	6.25±0.17	5.75±0.12	4.33±0.21	3.5±0.22	$5.89±0.15^{A}$
T1	8.16±0.3	7.85±0.07	6.55±0.2	5.9±0.06	4.33±0.21	3.55±0.24	$6.05±0.18^{B}$
T2	7.93±0.26	7.66±0.28	6.23±0.16	5.66±0.21	4.25±0.17	3.72±0.23	$5.90±0.21^{A}$
T3	7.93±0.26	7.82±0.27	6.23±0.16	5.7±0.19	4.18±0.16	3.46±0.18	5.89±0.2A
Overall mean	$7.96±0.23^{f}$	$7.76±0.17^{e}$	$6.31±0.17^{d}$	$5.75±0.14^{c}$	$4.27±0.19^{b}$	$3.55±0.21^{a}$	
			Juiciness				
C	8.0±0.36	7.85±0.13	7.11±0.12	6.71±0.11	6.03±0.26	5.48±0.19	$6.86±0.19^{A}$
T1	8.0±0.36	7.85±0.13	7.23±0.09	6.83±0.08	6.62±0.11	5.50±0.06	$7.0±0.14^{B}$
T2	8.1±0.2	7.97±0.11	7.4±0.15	7.16±0.21	6.95±0.23	5.58±0.23	$7.19±0.19^{C}$
T3	7.85±0.08	7.73±0.33	7.15±0.3	6.725±0.28	6.35±0.12	5.47±0.21	$6.88±0.22^{A}$
Overall mean	$7.98±0.25^{f}$	$7.85±0.17^{e}$	$7.22±0.16^{d}$	$6.85±0.17^{c}$	$6.48±0.18^{b}$	$5.50±0.17^{a}$	
			Tenderness				
C	8.16±0.09	7.91±0.11	7.31±0.18	6.85±0.14	6.4±0.07	5.45±0.17	$7.01±0.13^{A}$
T1	8.16±0.3	7.9±0.19	7.45±0.15	6.89±0.15	6.42±0.06	5.45±0.17	$7.04±0.17^{A}$
T2	8.21±0.3	8.0±0.14	7.53±0.14	6.92±0.15	6.5±0.06	5.75±0.27	$7.15±0.18^{B}$
T3	8.15±0.29	7.73±0.39	7.41±0.09	6.95±0.18	6.36±0.2	5.58±0.2	$7.03±0.2^{A}$
Overall mean	$8.17±0.24^{f}$	$7.88±0.20^{e}$	$7.42±0.14^{d}$	$6.90±0.15^{c}$	$6.42±0.1^{b}$	$5.55±0.2^{a}$	
			Overall acceptability				
C	8.15±0.1	7.85±0.24	5.66±0.55	4.63±0.2	3.66±0.1	3.03±0.21	$5.50±0.23^{A}$
T1	8.28±0.18	8.00±0.36	5.91±0.37	4.68±0.37	3.66±0.37	3.08±0.37	$5.60±0.33^{B}$
T2	8.23±0.14	7.90±0.06	5.96±0.33	4.73±0.12	4.02±0.18	3.23±0.42	$5.68±0.20^{C}$
T3	8.11±0.15	7.86±0.08	5.63±0.30	4.43±0.12	3.66±0.42	3.0±0.42	$5.45±0.24^{A}$
Overall mean	$8.19±0.14^{f}$	$7.90±0.20^{e}$	$5.79±0.40^{d}$	$4.61±0.20^{c}$	$3.75±0.30^{b}$	$3.08±0.35^{a}$	

Means bearing at least one common superscript in the same row and in the same column do not differ significantly ($p>0.05$)

C: Control chicken meat patties; **T1:** Chicken meat patties added with 1 percent curry leaf powder (CLP); **T2:** Chicken meat patties added with 5 percent tomato paste (TP); **T3**: Chicken meat patties added with 0.01 percent Butylated Hydroxy Anisole (BHA)

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