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A COMPARATIVE STUDY OF GREEN TEA EXTRACT AND ROSEMARY EXTRACT ON QUALITY CHARACTERISTICS OF CHEVON PATTIES

Pinky Moni Nath[1], Vinod Kumar[2], Praveen Kumar Praveen[3], Subha Ganguly[4]*

[1]Department of Livestock Products Technology, Lakhimpur College of Veterinary Science, Assam Agricultural University, Assam, India; [2] Department of Livestock Products Technology, Faculty of Veterinary and Animal Sciences, West Bengal University of Animal and Fishery Sciences, 37, K.B. Sarani, P.O. Belgachia, Kolkata – 700037, West Bengal, India; [3]Department of Veterinary Public Health and Epidemiology, [4]Department of Veterinary Microbiology, Arawali Veterinary College (Affiliated with Rajasthan University of Veterinary and Animal Sciences, Bikaner), N.H - 52 Jaipur Road, V.P.O. Bajor, Sikar - 332001, Rajasthan, India

E-mail: ganguly38@gmail.com (**Corresponding Author*)

Abstract: The study was conducted to evaluate the physico-chemical, microbial and organoleptic qualities of chevon patties treated with 2% levels of green tea extract (GTE) and rosemary extract (RE). Samples were stored for 0, 5, 10 and 15 days at 4±1^{o}C. GTE treated meat samples significantly (P≤0.05) improved meat pH and lowered thiobarbituric acid (TBA) value as compared to control and RE treated samples. Microbial load and peroxide values in GTE added samples was found to be decreased significantly (P≤0.05) as compared to control and RE treated sample. No significant (P≤0.05) difference has been observed in texture scores between control and the treated meat samples. There were significant differences (P≤0.05) between control samples and samples treated with GTE and RE in terms of peroxide values. Treated samples with GTE developed low peroxide values compared with control and RE sample. The overall acceptability and flavor of RE treated samples products was highest (P≤0.05) as compared to control and GTE treated sample. RE and green tea were the most effective antioxidants in stabilization of a* value of meat patties. GTE and rosemary extracts were effective antioxidants and strongly inhibited oxidation. Present findings shows that GTE and RE exhibit greater antioxidant and antimicrobial efficiency and meat colour stabilization.

Key words: Chevon patties, natural antioxidants; rosemary extract (RE) and green tea extract (GTE).

INTRODUCTION

Consumers' demand for natural products, as well as their concern over commonly used synthetic antioxidants, suggests that it is important to identify functional natural antioxidants to use in meat and poultry products. For the consumer preference, the meat and poultry industry is actively seeking natural solutions to minimize oxidative rancidity and increase the

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shelf-life of their products.[1] Lipid oxidation is important to the meat and poultry industry because it is one of the major causes of quality deterioration.[2] Processed meats are highly susceptible to lipid oxidation because they are commonly ground, they are often cooked, and they generally contain salt.[3] Grinding promotes lipid oxidation because it increases the exposure of lipids to air.

In the present study Green tea extract and Rosemary extract has been chosen for its antioxidant properties correlated with the presence of tea catechins [4,5] and rosemary for content of certain compounds including rosmanol, rosmariquinone, rosmaridiphenol, carnosol [6,7], Green tea (*Camellia sinensis*) is the most widely consumed beverage, following water, and may have cancer preventive effects in vivo.

Green tea contains several groups of polyphenols that include flavonds, caffeine, phenolic acid, flavor compounds and leucoanthocyanins, accounting for up 40% of dry leaf weight [8] are thought to be responsible for the cancer preventive effects observed in laboratory and epidemiological studies. Catechins are the main bioactive constituents of green tea leaves and account for 25 – 35% of their dry weight. [9]. Tea catechin can act as antioxidants by donation of a hydrogen atom, as an accepter of free radicals, interrupting chain oxidation reaction or by chelating metals. [10] Addition of green tea extract helped in prevention of metmyoglobin formation which stabilized the color of product during chilling storage.[11]

Among herbs, rosemary (*Rosmarinus officinalis L.*) is the only one that is explored commercially as a natural antioxidant. Rosemary products have been used as successful antioxidants in vacuum packaged raw ground beef and pork [3], cooked ground beef [12], and more effective than a combination of BHA/BHT in raw frozen sausage [13].

The objective of the study was to compare the effect of green tea extract and rosemary extract on quality characteristics of chevon patties during refrigerated storage.

MATERIALS AND METHODS

Materials: Chevon, Green Tea leaves and Rosemary leaves were obtained from local market in Lakhimpur, Assam. Chemicals and 2-Thiobarbituric acid were obtained from chemical shop.

Preparation of chevon patties: Chevon were purchased fresh from a local market. Boneless chevon, non-meat ingredients such as salt, sugar, spice mix, condiments etc. were used as per the formulation presented in table 1.

Table 1: Formulations of the meat patties

Ingredients	C	GTE	RE
Lean meat (%)	55.00	55.00	55.00
Chicken fat including Skin (%)	5.00	5.00	5.00
Whole egg (%)	20.00	20.00	20.00
Condiments (%)	4.00	4.00	4.00
Spice mix (%)	3.34	3.34	3.34
Corn flour (%)	10.00	10.00	10.00
Table salt (%)	1.50	1.50	1.50
Sugar (%)	1.00	1.00	1.00
Monosodium glutamate (%)	0.03	0.03	0.03
Baking powder (%)	0.13	0.13	0.13
Green Tea Extract (%)		2.0	
Rosemary Extract (%)			2.0

C: control, GTE: Green Tea Extract, RE: Rosemary Extract

Chevon was trimmed of visible fat and connective tissue, their fat contents were determined and they were then frozen at -20 °C until processing. After thawing, they were ground separately using a conventional meat grinder through a plate with 6 mm steel plate. The raw materials were then thoroughly mixed at an appropriate ratio to achieve a fat content of approximately 15% in the mixture and were ground again through a 4 mm steel plate. The minced meat samples were divided into three equal proportions. To one part, plant extract was not added i.e. control and to the other two parts 2% of GTE and 2% of RE was added separately in each sample. Chevon patties were formed using a meat former, and placed on plastic foam trays. Oven cooking method was used for cooking of meat patties at 180^0C for 25 min. Care was taken to maintain the internal temperature within 75^0C $\pm 1^0$C. After cooking the chevon patties were wrapped with polyethylene film and kept in a refrigerator at 4 ± 1^0C and evaluated for physiochemical, microbial and sensory attributes after every 5 days interval up to 15 days.

Plant extracts preparation - Green tea extract and Rosemary extract are prepared by adding 1 gm. of dried green tea leaves and rosemary leaves to 100 ml of distilled water. Extraction was done at room temperature for 60 minutes, followed by filtrate the extract by Whatman No. 1 filter papers. Green tea extract and Rosemary extract was mixed with ground meat at (2.0%). Samples were formed as patties shape and stored at 4 ± 1^oC.

Determination of pH: Homogenates were prepared by blending 10 g of patties with 50 ml of distilled water for 60 s and readings were taken with a pH-meter.

Measurement of lipid oxidation: The lipid oxidation was determined by assaying values of TBARS according to the method of Pikul *et al*. [14]. Intensity of color produced in the reaction of malondialdehyde with 2-thiobarbituric acid was measured by means of Nicole Evolution 300 spectrophotometer (Thermo Electron Corporation) at a wave length of 532 nm. The values of TBARS, were expressed in mg malondialdehyde per 1 kg of meat product

Color Measurement: Internal color of control and treated samples was determined by using a Hunterlab colorimeter (Model D25M), Values for L* (lightness), a* (redness) and b* (yellowness) were recorded for 3 samples per batch using a 25 mm aperture.

Sensory evaluation: Ten panelists were selected base on taste identification tests, to evaluate sensory properties of different treated samples. 10 mm thick from the samples were served to the panelists. Color, flavor, texture and overall acceptability were evaluated on 8-point descriptive scales.

Peroxide Value: Test was measured on duplicate 5 g. samples were measured after every 5 days interval uto 15 days according to AOAC (1980) Method No. 28.023 [15].

Microbial sampling and analysis: After every 5 days interval of storage at 4 ± 1^{0}C, the meat samples were analyzed for total psychrothrophic bacteria count as described in ICMSF [16]. Following incubation at 4 ± 1ºC plates showing colonies were counted and expressed as log 10 (Colony-forming units (CFU)) g^{-1} sample.

Statistical analysis

Data were subjected to analysis of variance (ANOVA) using statistical SPSS to evaluate the statistical significance among the samples.

RESULTS AND DISCUSSION

pH: The results showed that the meat samples with addition of GTE had significantly ($P\leq0.05$) higher pH values compared to control samples and RE treated sample, this may due to green tea extract pH close to (7.70) as reported by Kobus-Cisowska *et al*. [17].

TBARS: Effects of extract addition and storage time on TBARS are shown in table 2. The most effective antioxidants is GTE than RE. However, the TBARS values of the samples with added green tea and rosemary were significantly ($p\leq0.05$) lower than the control. A significant difference ($p\leq0.05$) were observed between GTE and rosemary. Mielnik *et al.* [18] reported that after 7 month of storage, TBARS values for rosemary treatments were lower ($p \leq 0.05$) when compared to the control.

Peroxide values: The results in table 2 shows that the levels of GTE added to samples are significantly (P≤0.05) lowered the peroxide values compared to RE and control samples. These results indicated that the GTE contains certain compounds which can lower the peroxide. These results agreed with the finding of McCarthy *et al.* [19] , reported that the catechins present in green tea leaves was the most effective in reducing lipid oxidation in fresh and frozen pork patties. There is an increase in peroxides value of control during storage. This agreed with the result reported by Gheisari [20] that peroxide values increased in cattle, chicken and camel meat during refrigerated storage. Mitsumoto *et al.* [21] reported that adding tea catechins to minced meat inhibited lipid oxidation in both raw and cooked beef meat to a greater extent.

Table 2: Evaluation of physiochemical and microbial quality of different treatments on goat patties during storage at (4±1˚C)

Parameters	**Storage days at 4 ±1^{o}C**			
	0	**5**	**10**	**15**
TBARS (mg malonaldehyde/kg sample)				
C	2.03 ±0.08^{a}	5.89 ± 0.28^{b}	11.73 ± 0.19^{a}	12.01±0.15^{c}
GTE	1.18 ± 0.05^{b}	1.35 ± 0.09^{a}	3.07 ± 0.12^{c}	4.01±0.13^{d}
RE	1.31 ± 0.02^{a}	1.92 ± 0.04^{a}	3.66 ± 0.10^{b}	6.02±0.23^{d}
Psychrotrophilic bacteria log10 CFU/g				
C	3.97 ± 0.08^{a}	4.20 ±0.12^{a}	6.09 ± 0.10^{a}	8.08±0.13^{b}
GTE	2.62 ± 0.04^{c}	3.06 ± 0.03^{d}	4.13 ±0.16^{e}	4.25±0.05^{f}
R E	3.81 ± 0.14^{b}	4.05 ± 0.10^{ab}	4.96 ±0.05^{ab}	5.23±0.02^{c}
Peroxide values (meq./Kg)				
C	2.48 ± 1.89^{a}	4.09 ± 2.75^{b}	7.27 ±3.90^{a}	8.49 ± 3.29^{c}
GTE	0.86 ± 0.18^{a}	1.33 ± 0.84^{ab}	1.85 ± 1.19^{b}	1.78 ± 1.45^{b}
RT	1.75±0.012^{a}	1.87±0.35^{b}	2.01±1.17^{c}	2.90±0.25^{c}
pH				
C	5.69±0.01^{a}	5.67±0.02^{b}	5.81±0.03^{a}	5.7±0.04^{c}
GTE	5.80± 0.01^{a}	5.91±0.04^{b}	6.01±0.01^{c}	6.20±0.01^{b}
RE	5.70±0.01^{a}	5.76±0.01^{a}	5.80±0.02^{b}	5.90±0.02^{c}

Means with different superscript letters are significantly different at P≤0.05.
C- control, GTE - Green Tea Extract, RE – Rosemary Extract

Colour: The result in table 3 shows that the L* was quite stable throughout storage in all treatments, as has been reported by Jo *et al.* [22]. In all samples L* values, were not significantly ($P \leq 0.05$) different throughout the storage period. Samples with GTE and RE had significantly higher ($P \leq 0.05$) mean a* values than the control. In all samples b* value decreased as the storage time was progressing. In all samples b* values, were not significantly ($P \leq 0.05$) different up to 5 days of storage. Significantly ($P \leq 0.05$) lowest b* values were observed for the sample with rosemary extract compared to other samples. Also significantly ($P \leq 0.05$) highest, yellowness values were noted in meat products with green tea extract addition, after 15 days of storage.

Table 3: Colour parameters of chevon patties supplemented with different antioxidant additives during refrigeration storage

Parameters	**Storage Days at 4±1^{O}C**			
Hunter L*	**0**	**5**	**10**	**15**
C	67.20±1.452^{a}	64.73±1.452^{bc}	65.26±1.452^{a}	64.23±1.452^{a}
GTE	65.96±1.452^{a}	61.96±1.452^{bc}	62.53±1.452^{a}	65.73±1.452^{a}
RE	63.46±1.452^{a}	66.23±1.452^{a}	66.80±1.452^{a}	63.53±1.452^{a}
Hunter a*	**0**	**5**	**10**	**15**
C	9.10±1.315^{a}	9.46±1.315^{a}	8.15±1.315^{a}	8.01±1.315^{a}
GTE	9.50±1.315^{a}	9.69±1.315^{a}	9.09±1.315^{ab}	9.03±1.315^{a}
RE	9.46±1.315^{a}	9.97±1.315^{b}	9.57±1.315^{ab}	9.40±1.315^{a}
Hunter b*	**0**	**5**	**10**	**15**
C	9.65±0.01^{a}	9.83±0.02^{a}	9.08±0.01^{b}	8.00±0.02^{b}
GTE	9.34±0.01 ^{a}	9.59±0.02^{b}	10.07 ±0.02^{a}	9.01±0.01^{c}
RE	9.44± 0.01^{ab}	9.00±0.54^{b}	9.15 ±0.02^{c}	7.71±0.01^{a}

Means with different superscript letters are significantly different at P≤0.05.
C: control, GTE: Green Tea Extract, RE: Rosemary Extract,
L* - Lightness, a* - Redness and b*- Yellowness

Microbial quality of cooked chevon patties during refrigerated storage: In The table 2 the study revealed that the microbiological evaluation of the meat patties during storage gave significant increased in the counts (log 10 cfu/g) of psychrotrophs. Control samples and those with RE showed no significant differences (P≥0.05) between them. RE had no added benefit of reducing microbial growth. On the other hand, meat patties with GTE showed the lowest microbial growth at all tested storage time compared to the control.

Sensory evaluation: The sensory scores of cooked chevon patties are shown in the table 4. The overall acceptability and flavor of products was highest (P≤0.05) in RE treated samples as compared with the control and GTE treated sample at the end of storage period. So it was clear that chevon patties made with RE was the most liked as they scored topmost in flavor and had significantly (P≤0.05) the highest sensory scores for overall acceptance than others. Abdel Hamied *et al.* [23] and Sallam *et al.* [24] indicated that organoleptic properties of mined beef treated with rosemary were acceptable by the panelists compared to untreated samples. On the other hand, chevon patties contained of GTE alone scored lowest in Flavor, probably due to odor of the native green tea extract. Results coincided with those previously obtained by Jo *et al.* [22]. However, insignificant differences (P≥0.05) were observed between texture of chevon patties among the tested samples.

Table 4: Sensory properties of cooked chevon patties supplemented with different antioxidant additives

Treatment	Sensory scores		
	Flavour	**Texture**	**Acceptability**
C	6.13 ± 0.01^{a}	6.27 ± 0.03^{a}	6.16 ± 0.12^{c}
GTE	5.15 ± 0.31^{a}	6.39 ± 0.04^{b}	5.82 ± 0.02^{d}
RE	7.56 ± 10^{a}	6.52 ± 0.13^{a}	7.30 ± 0.32^{a}

Means with different superscript letters are significantly different at P<0.05.
C: control, GTE: Green Tea Extract, RE: Rosemary Extract

CONCLUSION

In conclusion, the addition of Green tea leaves and Rosemary leave extract was highly effective in reducing lipid oxidation of chevon patties and extend their shelf life. GTE and RE have the lowest TBARS values the throughout the storage period and also GTE and RE showed significant antimicrobial activity. Thus, it can be concluded that GTE and RE is an effective antioxidant and antimicrobial agent for the control of spoilage in chevon meat. Hence GTE and RE up to 2% level at refrigeration storage enhance color and lipid oxidation stability which are very important attributes of meat products. The effects of these natural antioxidants can be use for improving meat stability and helps in extending the shelf life of meat products.

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