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Utilization of Gooseberry as Natural Antioxidant for Development of Functional Mutton Rolls

Apoorva Argade, Ashok Malik, Vaquil, Rekha Devi, Sanjay Yadav and S.S. Ahlawat*

Department of Livestock Products Technology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, INDIA

**Corresponding author: SS Ahlawat; Email: ahlawatss9@gmail.com*

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ABSTRACT

This study was conducted with an objective to utilize the gooseberry powder and its extracts as natural antioxidant for development of functional mutton rolls. Incorporation of gooseberry powder at 1, 2 and 3 per cent levels, and gooseberry aqueous and ethanolic extracts at 5, 10 and 15 per cent levels were compared with control sample, and selected on the basis of sensory evaluation. The total phenols and TBARS value of selected products were compared with control. The sensory scores including overall acceptability increased with the incorporation levels of gooseberry aqueous and ethanolic extracts, and decreased with the increasing levels of gooseberry powder. Addition of one per cent gooseberry powder and 10 per cent of its aqueous and ethanolic extracts were found suitable for incorporation in mutton rolls indicating moderate acceptability scores (round 7.00). The addition of gooseberry increased the total phenols and TBARS values were found significantly lower as compared to control and BHT treated products. It was concluded that gooseberry powder (1%) and gooseberry aqueous and ethanolioc extracts (10%) can be used for development of functional mutton rolls without compromising the acceptability scores of the product.

Keywords: Gooseberry, mutton rolls, sensory, TBARS

Major strategies for preventing oxidation in meat and meat products are the use of antioxidants and restricting the access to oxygen during storage (Tang *et al*., 2001). Synthetic antioxidants BHA (butylated hydroxyl anisole) and BHT (butylated hydroxyl toluene or propyl gallate) have been successfully used in order to prevent such oxidation in fresh meat. However, BHA (Sherwin, 1990) and BHT (Chen *et al*., 1992) are suspected to be carcinogens, and consumer concern has lead to a decrease in their use in the food. This is one of the reasons for the increased demand of the healthy (natural and functional) food (Rojas and Brewer, 2007).

Use of natural preservatives to increase the shelf-life of meat products is a promising technology since many herbs, plants, vegetable and fruits extracts or their powders have antioxidant and antimicrobial properties (Biswas *et al*., 2011). Gooseberry (*Emblica officinalis*) is good source of antioxidants like vitamin C, tannin, trigalloyl, polyphenol, flavonoids, ellagic acid and phyllembic acid (Anilakumar *et al*., 2004). *Amla* has also been reported to possess antifungal, antibacterial and antiviral activities (Godbole and Pendse, 1960).

Very little work has been done on the development of meat products using gooseberry as natural antioxidant and antimicrobial agents. Hence, keeping above points in view, this study was carried out.

MATERIALS AND METHODS

Healthy sheep meat (of age 10-12 months) was procured from local market of Hisar city and transferred to department of Livestock Products Technology (in ice box), College of Veterinary Sciences, LUVAS, Hisar. Sheep meat was washed thoroughly and deboned manually after trimming of fat and connective tissue and was frozen

for 18-24 hours and then minced in an electrical mincer to use for preparation of meat rolls. Gooseberries were also procured from the local market of Hisar city.

The fresh spice ingredients, condiment mix, table salt, binder (egg), sunflower oil and chemicals used in the investigation were procured from the local market through local suppliers from respective companies.

Preparation of gooseberry powder and extracts

Gooseberry were dried in hot air oven drier at 48±2°C for 36 hrs and ground to fine powder in an electric mixer. The fine powdered gooseberry was used to make ethanolic and aqueous extract as per the method prescribed by Khandelwal (2002). Ten per cent ethanolic and aqueous extract of gooseberry were made by dissolving 10g of powder in 100 ml of 95% ethyl alcohol and 100 ml of distilled water, respectively. The flask containing the extract was kept on the orbital shaker for 3 hrs, and then incubated at 37°C for 72 hrs. The extract was filtered through Whatman filter paper No. 1. The filtrate was then dried in hot air oven drier for 12-14 hrs till a final concentration of 50±2% was obtained.

Preparation of mutton rolls

Gooseberry powders (mixed in chilled water) and extracts (aqueous and ethanolic extracts) were added, independently, at different levels with other additives same as in control meat rolls and mixed in an electric mixer for 2 minutes to prepare stable emulsion.

The prepared emulsion was stuffed in autoclavable beakers manually and uniformly distributed with the help of a glass rod. The beakers were covered with aluminium foil and pressure cooked for 30 minutes at low gas flame. After cooking, rolls were taken out and cooled to room temperature, packaged in polythene bags and stored at refrigerated temperature (4+1°C) for further use.

Analysis

A six member experienced panel of judges consisting of teachers and postgraduate students of College of Veterinary Science, LUVAS, Hisar, evaluated the samples for the sensory attributes using 9-point Hadonic scale (Keeton, 1983), where 9=extremely like and 1=extremely dislike. The test samples were presented to the panelists after assigning the suitable codes. The samples were warmed in a microwave oven for 20 sec before serving to the sensory panelists. The water was served for rinsing the mouth between the samples.

Total phenolic content was estimated by Folin Ciocalteu's method. The data for total phenolic contents of polyherbal formulation were expressed as mg of gallic acid equivalent weight (GAE)/ 100 g of dry mass (Kamtekar *et al.*, 2014). The TBARS value was determined according to the method of Witte *et al*. (1970).

The experiment was repeated thrice in duplicate and the results were analyzed using completely randomized design as per Snedecor and Cochran (Snedecor and Chochran, 1994). The data were subjected the statistical analysis using SPSS MAC, version 22.0, SPSS Chicago (USA).

RESULTS AND DISCUSSION

Sensory evaluation

All the sensory scores of gooseberry powder (one per cent) added mutton rolls were comparable to control and BHT treatment (Table 2). Further incorporation of gooseberry powder declined the sensory scores significantly ($p<0.05$) including overall acceptability.

The sensory scores with addition of 10 per cent gooseberry aqueous extract were almost similar to control except tenderness, which was highest, but further addition of gooseberry aqueous extract also decreased the sensory scores significantly ($p<0.05$).

The panalists rated significantly ($p<0.05$) more sensory score for addition of gooseberry ethanolic extract at 10 per cent level except flavour score, which was similar to control. Further addition of gooseberry ethanolic extract decreased the sensory score significantly ($p<0.05$). Najeeb *et al.* (2014) also reported the incorporation of gooseberry in chicken patties did not much effect the colour and flavor scores as compared to control.

However, the overall acceptability score of one percent gooseberry powder and 10 percent its aquous extract incorporated mutton rolls were statistically ($p<0.05$) similar to control and BHT treatments but Further incorporation of gooseberry powder and gooseberry

Table 1: Formulation of control and treated mutton rolls

Treatments	Ingredients (g)							
	Meat	Salt	Egg	Spice mix	Ginger:Garlic (1:1	Sunflower Oil	Treatments	Total Qty
C_1	76.58	2	10	2	4	5	—	99.58
C_2	76.57	2	10	2	4	5	0.01	99.58
T_1	75.58	2	10	2	4	5	1	99.58
T_2	74.58	2	10	2	4	5	2	99.58
T_3	73.58	2	10	2	4	5	3	99.58
T_4	71.58	2	10	2	4	5	5	99.58
T_5	66.58	2	10	2	4	5	10	99.58
T_6	61.58	2	10	2	4	5	15	99.58
T_7	71.58	2	10	2	4	5	5	99.58
T_8	66.58	2	10	2	4	5	10	99.58
T_9	61.58	2	10	2	4	5	15	99.58

C_1: Control-Meat rolls without BHT and gooseberry; C_2: BHT-Meat rolls with 100 ppm BHT as synthetic preservative; T_1, T_2, T_3: Meat rolls incorporated with 1, 2 and 3% of Gooseberry Powder; T_4, T_5, T_6: Meat rolls incorporated with 5, 10 and 15% of Gooseberry Aqueous extract; T_7, T_8, T_9: Meat rolls incorporated with 5, 10 and 15% of Gooseberry Ethanolic Extract.

Table 2: Sensory evaluation of cooked mutton rolls incorporated with gooseberry powder and its extracts. (n=6)

Treatments	Parameters					
	Appearance	Flavour	Texture	Tenderness	Juiciness	Overall acceptability
C	$7.33^{cd} \pm 0.16$	$7.16^{de} \pm 0.16$	$7.16^{cd} \pm 0.30$	$6.66^{d} \pm 0.21$	$6.83^{cde} \pm 0.16$	$7.33^{cde} \pm 0.21$
BHT	$7.16^{bc} \pm 0.16$	$7.16^{de} \pm 0.16$	$7.16^{cd} \pm 0.30$	$6.66^{d} \pm 0.21$	$6.83^{cde} \pm 0.16$	$7.00^{cd} \pm 0.02$
GP-1%	$7.50^{def} \pm 0.22$	$7.16^{de} \pm 0.16$	$7.16^{cd} \pm 0.30$	$7.66^{de} \pm 0.21$	$6.83^{cde} \pm 0.16$	$7.00^{cd} \pm 0.01$
GP-2%	$5.66^{a} \pm 0.21$	$5.68^{ab} \pm 0.33$	$5.33^{abc} \pm 0.21$	$5.33^{abc} \pm 0.21$	$5.66^{b} \pm 0.21$	$5.61^{b} \pm 0.01$
GP-3%	$5.50^{a} \pm 0.22$	$5.50^{bc} \pm 0.22$	$5.16^{ab} \pm 0.16$	$5.16^{ab} \pm 0.16$	$5.50^{ab} \pm 0.22$	$5.30^{a} \pm 0.16$
GAE-5%	$7.16^{bc} \pm 0.16$	$7.16^{de} \pm 0.16$	$7.16^{cd} \pm 0.16$	$6.66^{d} \pm 0.33$	$6.66^{cd} \pm 0.21$	$6.83^{cd} \pm 0.16$
GAE-10%	$7.50^{def} \pm 0.22$	$7.33^{de} \pm 0.21$	$7.33^{de} \pm 0.21$	$7.83^{ef} \pm 0.16$	$7.33^{def} \pm 0.21$	$7.33^{cde} \pm 0.22$
GAE-15%	$6.66^{bc} \pm 0.21$	$5.83^{bc} \pm 0.16$	$6.33^{b} \pm 0.33$	$5.66^{bc} \pm 0.21$	$6.33^{c} \pm 0.21$	$6.00^{b} \pm 0.21$
GEE-5%	$7.50^{def} \pm 0.22$	$7.66^{ef} \pm 0.21$	$6.50^{bc} \pm 0.22$	$5.83^{c} \pm 0.16$	$6.83^{cde} \pm 0.16$	$6.66^{c} \pm 0.25$
GEE-10%	$8.16^{g} \pm 0.30$	$7.33^{de} \pm 0.21$	$8.00^{ef} \pm 0.36$	$8.33^{f} \pm 0.21$	$7.83^{f} \pm 0.16$	$8.16^{g} \pm 0.21$
GEE-15%	$7.00^{bcd} \pm 0.25$	$6.00^{c} \pm 0.25$	$6.33^{b} \pm 0.33$	$6.50^{d} \pm 0.22$	$6.50^{c} \pm 0.22$	$5.83^{b} \pm 0.16$

Mean ± SE with different small letter superscripts column wise differ significantly ($p<0.05$); C= control, BHT=100ppm, GP= gooseberry powder, GAE= gooseberry aqueous extract, GEE= gooseberry ethanolic extract.

aquous extract significantly ($p<0.05$) declined the overall acceptability scores as compared to control.

Gooseberry ethanolic extract incorporation at 10 percent level showed significantly ($p<0.05$) higher overall acceptability scores as compared to control and further addition of its ethanolic extract at 15 percent level significantly ($p<0.05$) decreased the score. The cumulative effect of colour, flavor, tenderness, texture and juiciness scores were reflected in over all acceptability scores also. These results are in accordance with the findings of Najeeb *et al.* (2014). Hence, the mutton rolls incorporated with 1% gooseberry powder, 10% gooseberry aqueous extract and 10% ethanolic extracts were selected for further studies.

Table 3: Total phenols and TBARS value of raw emulsion and cooked mutton rolls treated with gooseberry powder and their extracts (n=6)

Treatments	Total penolic contents (mg gallic acid equivalent /gm)		TBARS Values (mg malondehyde/kg)	
	Raw emulsion	Cooked rolls	Raw emulsion	Cooked rolls
C	0.38^{aA}±0.01	0.34^{aA}±0.01	0.35^{cA}±0.010	0.44^{cB}±0.06
BHT	0.78^{bA}±0.02	0.69^{bB}±0.01	0.27^{bA}±0.003	0.36^{bB}±0.02
GP	2.91^{cA}±0.02	2.53^{cB}±0.02	0.20^{aA}±0.007	0.26^{aB}±0.01
GAE	3.12^{dA}±0.09	2.64^{cB}±0.02	0.19^{aA}±0.005	0.25^{aB}±0.02
GEE	3.74^{eA}±0.03	3.08^{dB}±0.02	0.18^{aA}±0.003	0.21^{aB}±0.01

Mean ± SE with different small letter superscripts column wise and capital letters row wise in different parameters differ significantly ($p \leq 0.05$); C= control, BHT= Butylated Hydroxyl Toulene, GP= Gooseberry powder (1%), GAE= Gooseberry aqueous extract (10%), GEE= Gooseberry ethanolic extract (10%).

Total phenols and TBARS value

Mutton emulsion treated with gooseberry showed significantly higher total phenols as compared to both control and BHT treatments. However, addition of BHT significantly increased the total phenols in raw emulsion as compared to control, but it was significantly lower than gooseberry treated products. Similar trend for total phenols was also observed in cooked mutton rolls. Increase in total phenols in treated raw emulsion and cooked products were due to incorporation of total phenols rich gooseberry powder and extracts. These results were in close agreement with Nampoothri *et al.* (2011), who estimated the total phenolic content in gooseberry aqueous extract (290.47 mg/g). Mayachiew *et al.* (2008) also reported that the amount of the total phenolic contents of Indian gooseberry extracts were 290.47 mg/g in dry sample. Cooking significantly decreased the total phenols as compared to raw emulsion and it might be due to some phenol content had been lost during cooking because of exposure of heat and could be due to leaching of phenols during fluid loss. An increase in TBARS value (mg malonaldehyde/kg) is an indicator of the development of oxidative rancidity and TBARS number has been found to be correlated to the total phenols of the product (Brewer *et al*., 1992).

Incorporation of gooseberry powder and its extracts showed their antioxidant activity and significantly ($P<0.05$) decreased the TBARS value as compared to control and BHT added mutton rolls in treated raw emulsion and cooked products. The possible reason could be, that gooseberry treated mutton rolls have higher total phenolic content than the control and BHT treatments. Cooking significantly increased the TBARS values as compared to raw emulsion. Naveen *et al.* (2016) also reported that even partially cooking increased the TBARS values in meat products.

CONCLUSION

It was concluded that gooseberry powder (one per cent), gooseberry aqueous and ethanolic extract (10 per cent each) can be incorporated as natural antioxidant for development of functional mutton rolls without compromising the sensory quality of the developed product.

REFERENCES

Anilakumar, K.R., Nagaraj, N.S. and Santhanam, K. 2004. Protective effects of amla on oxidative stress and toxicity in rats challenged with dimethyl hydrazine. *Nutri. Res.,* **24**(4): 313-319.

Biswas, A.K, Kumar, V., Bhosle, S., Sahoo, J. and Chatli, M.K. 2011. Dietary fibers as functional ingredients in meat products and their role in human health. *Int. J. Live. Prod*., **2**(4): 45-54.

Brewer, M.S., Ikins, W.G. and Harbers, C.A.Z. 1992. TBA values, sensory characteristics and volatiles in ground pork during long-term frozen storage: Effects of packaging. *J. Food Sci.,* **57**: 558-563.

Chen, Y., Hennessy, K.M., Botstein, D. and Tye, B.K. 1992. CDC46/MCM5, a yeast protein whose subcellular localization is cell cycle-regulated, is involved in DNA replication at autonomously replicating sequences. *Proc. Natl. Acad. Sci. U.S.A.,* **89**(21): 10459-63.

Godbole, S.H. and Pendse, G.S. 1960. Antibacterial property of some plants. *Ind. J. Pharmacy*., **22**: 39–42.

Kamtekar, S., Keer, V. and Patil, V. 2014. Estimation of Phenolic content, Flavonoid content, Antioxidant and Alpha amylase

Inhibitory Activity of Marketed Polyherbal Formulation. *J. Appl. Pharm. Sci*., **4**(9): 61-65.

Keeton, J.T. 1983. Effect of fat and NaCl/phosphate levels on the chemical and sensory properties of pork patties. *J. Food Sci.,* **48**: 878-881.

Khandelwal, K.R. 2002. Practical Pharmacognosy, Technique and Experiments. 9th Ed., Nirali Prakashan, pp. 23.10 to 23.11 and 25.1 to 25.6.

Mayachiew, P. and Devahastin, S. 2008. Antimicrobial and antioxidant activities of Indian gooseberry and galangal extracts. *LWT-Food Sci. Technol.*, **41**(7): 1153-1159.

Najeeb, A.P., Mandal, P.K. and Pal, U.K. 2014. Efficacy of fruits (red grapes, gooseberry and tomato) powder as natural preservatives in restructured chicken slices. *Int. Food Res. J.,* **21**(6): 2431-2436.

Nampoothiri, S.V., Prathapan, A., Cherian, O.L., Raghu, K.G., Venugopalan, V.V. and Sundaresan, A. 2011. *In vitro* antioxidant and inhibitory potential of *Terminalia bellerica* and *Emblica officinalis* fruits against LDL oxidation and key enzymes linked to type 2 diabetes. *Food Chemi. Toxico*., **49**(1): 125-131.

Naveen, Z., Naik, B.R., Subramanyam, B.V. and Reddy, P.M. 2016. Studies on the quality of duck meat sausages during refrigeration. *Springer Plus.*, **5**: 2061.

Rojas, M.C. and Brewer, M.S. 2007. Effect of natural antioxidants on oxidative stability of cooked, refrigerated beef and pork. *J. Food Sci.,* **72**(4): S282-S288.

Sherwin, E.R. 1990. Antioxidants. In: Food Additives, R. Branen (Ed.), Marcel Dekker, New York, pp. 139.

Snedecor, G.W. and Cochran, W.G. 1994. Statistical methods. Oxford and IBH Publishing.

Tang, S., Sheehan, D., Buckley, D.J., Morrissey, P.A. and Kerry, J.P. 2001. Antioxidant activity of added tea catechins on lipid oxidation of raw minced red meat, poultry and fish muscle. *Int. J. Food Sci. Technol*., **36**: 685–92.

Witte, V.C., Krause, G.F. and Bailey, M.F. 1970. A new extraction method for determining 2-thiobarbituric acid values of pork and beef during storage. *J. Food Sci*., **35**(5): 582-585.