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Research Article

EFFECT OF GOOSEBERRY INCORPORATION ON INSTRUMENTAL TEXTURE AND COLOUR PROFILE ANALYSIS OF DEVELOPED FUNCTIONAL MUTTON ROLLS

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ABSTRACT

The study was conducted to evaluate the effect of gooseberry incorporation on instrumental texture and colour profile of developed functional mutton rolls. Gooseberry powder at 1 percent level; gooseberry aqueous and ethanolic extract at 10 per cent level, each were incorporated besides other ingredients which were added in control. Instrumental texture (Hardness, Springiness, Cohesiveness, Chewiness and Gumminess) and instrumental colour (L*: Lightness, a*: Redness and b*: Yellowness) profile values were evaluated. A significantly higher value for hardness, springiness, chewiness and gumminess, and lower value for cohesiveness was found in developed mutton rolls as compared to control. The addition of gooseberry lowered the L* and b* values, but resulted in an increase in a* value for colour. It was concluded that incorporation of gooseberry in functional mutton rolls significantly improved the instrumental texture and colour profile characteristics.

Key words: Colour, Gooseberry, Mutton rolls, Texture

The understanding of relationship between nutrition and health has resulted in the development of concept of functional foods (Bhat and Bhat, 2011). It clubs the technologically developed ingredients with a specific health benefit (Niva, 2007). Use of natural preservatives to increase the shelf-life of meat products is a promising technology as many plant extracts or powders to possess antioxidant and antimicrobial properties have been mentioned by Biswas *et al.* (2012).

Gooseberry (*Emblica officinalis*) (Amla in Hindi) is a wonder herb and one of the precious gifts of nature to humans because it is a good source of non enzymatic antioxidants like vitamin C, emblicanin A, tannin, trigalloyl, polyphenol, flavonoids, ellagic acid and phyllembic acid (Anilakumar *et al.*, 2004).

Altered socioeconomic equations in recent years have immensely raised the preference of the consumers towards ready to eat foods including meat products (Perez-Alvarez, 2008); sheep and goat meat is highly preferred because it has no religious taboo in India. Texture and colour is an important visual cue involved in consumer perception of acceptable meat quality (Rojas and Brewer, 2007).

Hence, the study was undertaken to evaluate the effect of gooseberry incorporation on instrumental texture and colour profile analysis of developed functional mutton rolls.

MATERIALS AND METHODS

Healthy sheep meat (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 pulp were dried in hot air oven drier at 48±2ºC 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) at 1 per cent and aqueous and ethanolic extracts at 10 per cent levels (each) were added, independently, with other additives same as in control meat rolls (Table 1) 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.

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Table 1
Formulation of control and treated mutton rolls

Ingredients (g)	C_1	C_2	T_1	T_2	T_3
Meat	76.58	76.57	75.58	66.58	66.58
Sodium chloride	2	2	2	2	2
Egg	10	10	10	10	10
STPP	0.4	0.4	0.4	0.4	0.4
Spice mix	2	2	2	2	2
Ginger:Garlic (1:1)	4	4	4	4	4
Sunflower Oil	5	5	5	5	5
Sodium nitrite	0.02	0.02	0.02	0.02	0.02
Treatments	-	0.01	1	10	10
Total Qty	100	100	100	100	100

C_1: Control-Meat rolls without BHT and gooseberry, C_2: BHT-Meat rolls with 100 ppm BHT as synthetic preservative, T_1: Meat rolls incorporated with 1 % of Gooseberry Powder, T_2: Meat rolls incorporated with 10% of Gooseberry Aqueous extract, T_3: Meat rolls incorporated with 10% of Gooseberry Ethanolic Extract

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.

Texture Profile Analysis: The textural properties of control, powder and extract of gooseberry treated product were evaluated using Texture Analyzer (TA.HD plus), Stable Micro Systems Ltd., Surrey, England with the Texture Exponent Program. A compression platform of 70 mm diameter was used as a probe. The Texture Profile Analysis (TPA) was performed as per the procedure outlined by Bourne (1978). Textural attributes such as hardness, springiness, cohesiveness, gumminess, chewiness were analyzed. Six readings were recorded for each sample.

1. Hardness (N) = maximum force required to compress the sample (H)
2. Springiness = ability of sample to recover its original form after a deforming force was removed (S)
3. Cohesiveness = extent to which samples could be deformed prior to rupture (A2/A1, A1 being the total energy required for first compression and A2 the total energy required for second compression);
4. Gumminess (N) = Hardness × Cohesiveness
5. Chewiness (N) = Springiness × Gumminess

Colour profile analysis: Colour profile of samples was measured using a Konica Minolta chroma meter CR-400 (Konica Minolta Sensing, Inc., Japan) with 8 mm aperture and D65 illuminant. The instrument was calibrated with a white standard plate. Colour scores were expressed as (CIE, Lab) L* (lightness), a* (redness) and b* (yellowness).

The experiment was repeated thrice in duplicate and the results were analyzed using completely randomized design as per Snedecor and Cochran (1994). The data were subjected to statistical analysis on'IBM SPSS- 22.0'(IBM Corp. Armonk, NY, 2013).

RESULTS AND DISCUSSION

Texture profile: The modification in texture is one of the important functional properties of plant additives in designer foods. A significantly higher value for hardness was found in mutton rolls containing one per cent of gooseberry powder and 10 percent of gooseberry aqueous and ethanolic extract (each) as compared to control (Table 2).

The higher value of hardness of meat rolls added with gooseberry powder as compared to control, could be due to incorporation of gooseberry particles in protein matrix that would have strengthened the binding during cooking. Hayat *et al.* (2014) reported that Hardness gradually increased with increasing levels of grape pomace powder in bread. The binding water by gooseberry powder fiber is likely to be resulted in increased the hardness value. Loss of moisture during cooking has also been explained the increase of hardness in treated meat products by Talukdar and Sharma (2010).

Springiness is how well a product physically springs back after it has been deformed during the first compression. These values are directly related to elastic properties of meat product (Saricoban *et al.*, 2009). However, all the treated samples showed significantly higher springiness value as compared to control, but the highest value was recorded in 10 per cent gooseberry

Table 2
Instrumental texture profile analysis of developed mutton rolls (n=6)

Treat-ments	Texture profile characteristics				
	Hard-ness (N)	Spring-iness	Cohesi-veness (ratio)	Chewi-ness	Gumm-iness (N)
C_1	28.39^{a} ±0.26	0.78^{a} ±0.003	0.49^{d} ±0.002	14.00^{b} ±0.16	10.99^{b} ±0.11
C_2	30.55^{b} ±0.09	0.83^{b} ±0.002	0.38^{a} ±0.002	11.60^{a} ±0.08	9.68^{a} ±0.15
T_1	41.43^{e} ±0.33	0.82^{b} ±0.004	0.41^{b} ±0.002	17.19^{c} ±0.14	14.18^{d} ±0.16
T_2	35.27^{d} ±0.21	0.86^{c} ±0.003	0.48^{d} ±0.003	17.22^{c} ±0.16	14.95^{d} ±0.13
T_3	32.09^{c} ±0.09	0.82^{b} ±0.004	0.43^{c} ±0.003	14.42^{b} ±0.10	11.82^{c} ±0.12

Mean ± SE with different small letter superscripts column wise differ significantly ($p \leq 0.05$). C_1= Control, C_2 = Butylated Hydroxyl Toulene, T_1 = Gooseberry powder (1%), T_2= Gooseberry aqueous extract (10%), T_3 = Gooseberry ethanolic extract (10%).

aqueous extract treatment. The springiness value of BHT, one percent gooseberry powder and 10 percent gooseberry ethanolic extract treatments were observed statistically (p≤0.05) similar but significantly lower as compared to gooseberry aqueous treated mutton rolls. This could be due to an increase in emulsion viscosity leading to greater elasticity of products added with gooseberry aqueous extract. Bishnoi and Ahlawat (2015) also reported the similar reasons for springiness of Aloe Vera gel and Arjun tree bark aqueous and ethanolic extract treated buffalo calf meat rolls.

Cohesiveness is how good the sample retains its structure after compression. The value for cohesiveness was highest in control followed by gooseberry aqueous extract, which were significantly (p ≤ 0.05) higher than gooseberry powder, gooseberry ethanolic extract and BHT treated rolls. A decrease in cohesiveness value due to incorporation of plants parts in meat has also been reported by Saricoban *et al.* (2009) in beef patties.

Chewinessis calculated using hardness as a factor, which suggests resistance to compression force. It measures the degree of difficulty in breaking down the internal structure of meat products. A significantly (p ≤ 0.05) higher value for chewiness was found in mutton rolls treated with gooseberry powder and its aqueous extracts than control, BHT and gooseberry ethanolic extract. As control, BHT and gooseberry ethanolic extract addition found lower in hardness than gooseberry powder and its aqueous extract treatments, and this softening of product led to lower in their chewiness values. Lee *et al.* (2008) reported similar results with incorporation of kimchi powder in emulsified pork meat balls.

Gumminess value is a derived value that depends upon hardness and cohesiveness of the products. The gumminess value was significantly (p≤0.05) higher in mutton rolls treated with gooseberry powder and its aqueous extract with respect to control including BHT and gooseberry ethanolic extract. These results are in accordance with the reports of Grige lmo-Mriguel *et al.* (1999) in frank furters and emulsified pork meatballs added with peach fiber and rice bran, respectively.

Colour profile: The analysis of L* values (denoting the lightness in mutton rolls) of instrumental colour characteristics showed that the gooseberry treatments significantly (P<0.05) decreased the values as compared to control and BHT treated mutton rolls (Table 3). Decrease in L* value in treatments might be due to the ability of the gooseberry to maintain the colour of the product by retarding the oxidation reaction.

The a* values (denoting the redness in mutton rolls) was found to be significantly (P<0.05) higher for gooseberry treated products as well as in BHT than control. It might have been occurred due to antioxidant and colour imparting effect of gooseberry powder and its extracts.

Table 3
Instrumental colour profile analysis of developed cooked mutton rolls (n=6)

Treatments	Colour profile characteristics		
	L* value (Lightness)	a* value (Redness)	b* value (Yellowness)
C_1	$53.48^{e}\pm0.15$	$10.36^{a}\pm0.21$	$12.47^{e}\pm0.09$
C_2	$47.65^{b}\pm0.17$	$11.68^{b}\pm0.08$	$11.50^{d}\pm0.03$
T_1	$46.21^{a}\pm0.36$	$12.60^{c}\pm0.20$	$11.06^{c}\pm0.15$
T_2	$48.64^{c}\pm0.27$	$13.19^{d}\pm0.24$	$10.74^{bc}\pm0.02$
T_3	$51.24^{d}\pm0.44$	$13.43^{d}\pm0.14$	$10.38^{a}\pm0.08$

Mean ± SE with different small letter superscripts column wise differ significantly (p<0.05). C_1 = Control, C_2 = Butylated Hydroxyl Toulene, T_1 = Gooseberry powder (1%), T_2 = Gooseberry aqueous extract (10%), T_3 = Gooseberry ethanolic extract (10%).

The b* values of instrumental colour parameter signifies the yellowness in a product and when the treated mutton rolls in this study were compared with control, it was found that the values for gooseberry treated products were significantly (P<0.05) lower than the control sample. Gooseberry powder incorporation showed significantly (P<0.05) higher value among all the treatments. These results were in line with the findings of Kumar *et al.* (2015).

CONCLUSION

It was concluded that incorporation of gooseberry powder at 1% and its aqueous and ethanolic extracts at 10% levels (each) for development of functional mutton rolls improved the instrumental texture and colour profile characteristics 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**: 313-319.

Bhat, Z.F. and Bhat, H. (2011). Functional meat products : a review. *Int. J. Meat Sci.* **1**: 1-14.

Bishnoi, S. and Ahlawat, S.S. (2015). Development of Buffalo Meat Rolls Incorporated with Aloe Vera Gel and Arjun Tree Bark Extract. *Haryana Vet.* **54**: 174-177.

Biswas, A.K., Chatli, M.K., Sahoo, J. and Singh, J. (2012). Storage stability of chicken meat patties, balls and nuggets incorporated with eugenol and chitosan at refrigeration temperature (4±1°C) under aerobic packaging condition. *Indian J. Poult. Sci.* **47**: 348-356.

Bourne, M.C. (1978). Texture profile analysis. *Food Technol.* **32**: 62-66.

Grigelmo-Miguel, N., Abadias-Seros, M.I. and Martin-Belloso, O. (1999). Characterization of low-fat high-density fibre frank furters. *Meat Sci.* **52**: 247-256.

Hayta, M., Ozugur, G.,Etgu, H. and Şeker, I.T. (2014). Effect of Grape (*Vitis Vinifera* L.) Pomace on the Quality, Total Phenolic Content and Anti Radical Activity of Bread. *J. Food Process. Preser.* **38**: 980-986.

IBM Corp. (2013). IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

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

Kumar, V., Chatli, M.K., Wagh, R.V., Mehta, N. and Kumar. P. (2015). Effect of the combination of natural antioxidants and packaging methods on quality of pork patties during storage. *J. Food Sci. Technol.* **52**: 6230–6241.

Lee, M.A., Han, D.J., Jeong, J.Y., Choi, J.H., Choi, Y.S., Ki, H.Y., Paik, H.D. and Kim, C.J. (2008). Effect of kimchi powder level and drying methods on quality characteristics of breakfast sausage. *Meat Sci.* **80**: 708-714.

Niva, M. (2007). 'All foods affect health': Understandings of functional foods and healthy eating among health-oriented Finns. *Appetite.* **48**: 384-393.

Perez-Alvarez, J.A. (2008). Overview of meat products as functional foods. In : Technological strategies for functional meat products development. Fernandez-Lopez and J.A., Perez- Alvarez (Edts., Transworld. Kerela, India. pp: 1-18.

Rojas, M.C. and Brewer, M.S. (2007). Effect of natural antioxidants on oxidative stability of frozen vacuum packaged beef and pork. *J. Food Qual.* **31**: 173–85.

Saricoban, C., Yilmaz, M.T. and Karakaya, M. (2009). Response surface methodology study on the optimization of effects off at, wheat bran and salton chemical, textural and sensory properties of patties. *Meat Sci.* **83**: 610-619.

Snedecor, G.W. and Cochran, W.G. (1994). Statistical methods. (9th edn.) Iowa State University Press. Ames, Iowa.

Talukdar, S. and Sharma, D.P. (2010). Development of dietary fiber rich chicken meat patties using wheat and oat bran. *J. Food Sci. Technol.* **47**: 224-229.