Haryana Vet. (June, 2020) **59(1),** 109-112 **Research Article**

STUDIES ON PHYSICO-CHEMICAL PROPERTIES OF DEVELOPED MUTTON ROLLS INCORPORATED WITH GOOSEBERRY POWDER AND ITS EXTRACTS

APOORVA ARGADE, ASHOK MALIK, 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-125004, India

Received: 18.10.2019; Accepted: 01.02.2020

ABSTRACT

The study was conducted with an objective to evaluate the effect of gooseberry incorporation on physicochemical properties of developed functional mutton rolls. The rolls were prepared with incorporation of gooseberry powder at 1 per cent and gooseberry aqueous and ethanolic extracts (each) at 10 per cent levels, besides other ingredients which were added in control. The addition of gooseberry powder and extracts lowered the per cent fat, protein, shear press, TBARS, pH values but resulted in an increase in per cent moisture, cooking yield, emulsion stability and fiber contents of the developed products. It is concluded that addition of gooseberry powder and its extracts substantially improved the physico-chemical quality characteristics of developed functional mutton rolls.

Keywords: Gooseberry, Mutton rolls, Physico-chemical, Quality.

Sheep and goat meat is highly preferred in India but lipid oxidation, after microbial spoilage, is the main cause of loss in quality of meat products (Gray *et al.*, 1996). It produces undesirable products (primary and secondary lipid oxidation, free radicals) from the sensory (color and taste) approach, which makes the food undesirable for human consumption. The main strategy to prevent oxidation in meat and meat products is to use antioxidants and restrict access oxygen (Tang *et al.*, 2001). Synthetic antioxidants like BHA and BHT have been successfully used in order to prevent it in processed meat but these are suspected to be carcinogens and due to consumer concern, their use in food is limited. This is one of the main reasons for the growing demand of natural antioxidants in processed meat products (Botterweck *et al.*, 2000).

Phenolic compounds in gooseberry have attracted much interest due to their antioxidant and antibacterial properties. It is a good source of non enzymatic antioxidants like vitamin C, emblicanin A and Benzymatic antioxidants as superoxide dismutase (SOD), catalase (CAT), glutathione peroxides, tannin, trigalloyl, polyphenol, flavonoids, ellagic acid and phyllembic acid (Anila Kumar *et al.*, 2004). Gooseberry has also been reported to possess antifungal, antibacterial and antiviral activities (Kumar *et al.*, 2017).

Hence, the study was undertaken to evaluate the effect of gooseberry incorporation on physico-chemical properties of developed functional mutton rolls.

MATERIALS AND METHODS

Healthy sheep meat (age10-12 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 (-18 ºC) for 20-24 hours and then minced in an electrical mincer (Mado Primus Meat Mincer-MEW-613) to use for preparation of meat rolls. Gooseberries were also procured from the local market of Hisar city.

The fresh spice ingredients, garlic and ginger paste (1:1), table salt, binder (egg), sunflower oil and chemicals used in the investigation were procured from the local market through local suppliers from respective companies. Spice ingredients after cleaning were oven dried at 42 ± 2 °C for 4 h for preparing final spice mix.

Preparation of gooseberry powder and extracts:

Gooseberry pulp was dried in hot air oven drier at 48±2 ºC for 36 hrs and ground to fine powder in an electric mixer. The fine powdered gooseberry was used to make aqueous and ethanolic 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 ºC for 72 hrs for better stability and extraction yield. The extract was filtered through Whatman filter paper No. 1. The filtrate was then dried in hot air oven drier at 60 ºC 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 250 ml

*Corresponding author:ahlawatss9@gmail.com

autoclavable beakers manually and uniformly distributed with the help of a spatula. 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 low density polythene bags and stored at refrigerated temperature (4+1 ºC) for further use.

Proximate composition:

The proximate composition (% moisture, protein, fat, ash and total crude fiber) were analyzed in duplicate using methods as per AOAC (1995) for developed functional mutton rolls.

pH:

To determining the pH of the product samples, the method suggested by Troutt *et al.* (1992) was followed. The pH was recorded by dipping the pH meter electrodes of pH meter (CyberScan pH 510, Eutech Instruments; Thermo Scientific) directly in the suspension.

Thiobarbituric acid reactive substances (TBARS):

The extraction method was followed as used by Witte *et al.* (1970) for evaluation of TBARS values. The optical density was measured spectrophotometrically at 532 nm using Genesys 10S UV-VIS, thermoscientific, VA.

Water holding capacity:

WHC was estimated according to Confrades *et al.* (2000) with slight modification. In a 100 ml polycarbonate centrifuge tube, finely minced meat sample (15g) was taken, and then 22.5 ml of 0.6 M NaCl solution was added to it, mixed with glass rod and stirred for 2 minutes on a mechanical shaker. After holding for 15 minutes at 4 ºC in order to allow the effect of salt to reach equilibrium, the meat slurry was again stirred for 1 minute on a shaker and immediately centrifuged at 5000 rpm for 15 minutes at refrigerated centrifuge (Eltek refrigerated centrifuge, model MP 400 R). The supernatant volume was measured and difference between the added and decanted solution was expressed as percentage of the weight of meat sample.

Emulsion Stability:

Stability of control and treated emulsions were determined using the method of Choi *et al.* (2009).

Cooking Yield:

Weight of meat rolls before and after cooking was recorded and yield was expressed in per cent.

Firmness and Toughness:

Shear force value (Firmness and Toughness) of developed functional mutton rolls was analyzed using Texture Analyzer (TA.HD plus), Stable Micro Systems Ltd., Surrey, England with the Texture Exponent Program. A compression platform of 75 mm diameter was used as a probe. Warner-Bratzler shear probe was used to measure shear force value. Force required to shear a 1cm^2 thick sample transversely was expressed in Newton (N).

Statistical analysis:

The experiments were replicated thrice and data were analyzed statistically on 'SPSS-16.0' (SPSS Inc., Chicago) software package as per standard methods (Snedecor & Cochran, 1994). The average values were presented with standard deviation at 5% ($p<0.05$) level of significance.

RESULTS AND DISCUSSION

Proximate composition of raw and cooked rolls:

The percent moisture content of raw mutton emulsion increased significantly with addition of gooseberry aqueous extract as compared to control (Table 2). This might be due to the direct addition of 10 percent water as gooseberry aqueous extracts.

Moisture content of gooseberry ethanolic extract treated cooked roll was significantly lower as compared to

Table 1

Composition of selected meat rolls of minced meat 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
Condiments (Ginger:Garlic) 1:1	4	4	4	4	4
Groundnut Oil	5	5	5	5	5
Sodium nitrite	0.02	0.02	0.02	0.02	0.02
Treatments	-	0.010	1	10	10
Total Qty	100	100	100	100	100

C_1: Control-Meat rolls without BHT and gooseberry, C_2: Positive control-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.

Table 2

Effect of gooseberry on proximate composition of raw and cooked mutton rolls

Parameters (%)	Treatments				
	Raw meat rolls				
	C_1	C_2	T_1	T_2	T_3
Moisture	$71.1^{a}\pm0.39$	$71.8^{ab}\pm1.09$	$72.1^{ab}\pm1.16$	$73.0^{b}\pm0.38$	$71.2^{ab}\pm0.26$
Protein	$16.47^{c}\pm0.34$	$16.21^{c}\pm0.25$	$14.94^{ab}\pm0.37$	$14.90^{a}\pm0.19$	$15.76^{bc}\pm0.15$
Fat	$10.04^{c}\pm0.16$	$9.93^{c}\pm0.18$	$9.10^{a}\pm0.22$	$9.34^{ab}\pm0.50$	$9.53^{b}\pm0.18$
Ash	$2.18^{a}\pm0.12$	$2.25^{a}\pm0.09$	$2.49^{bc}\pm0.12$	$2.40^{b}\pm0.14$	$2.53^{c}\pm0.09$
	Cooked meat rolls				
Moisture	$64.57^{b}\pm0.19$	$64.26^{ab}\pm0.17$	$64.33^{ab}\pm0.29$	$64.50^{ab}\pm0.32$	$63.89^{a}\pm0.22$
Protein	$19.67^{c}\pm0.42$	$19.98^{c}\pm0.50$	$18.48^{a}\pm0.43$	$19.12^{b}\pm0.52$	$20.06^{c}\pm0.40$
Fat	$12.36^{a}\pm0.17$	$12.22^{a}\pm0.32$	$12.45^{a}\pm0.17$	$12.36^{a}\pm0.21$	$12.37^{a}\pm0.16$
Ash	$2.75^{b}\pm0.04$	$2.58^{a}\pm0.02$	$3.71^{d}\pm0.07$	$3.13^{c}\pm0.06$	$3.13^{c}\pm0.06$
Crude Fibre	$0.33^{a}\pm0.04$	$0.33^{a}\pm0.02$	$0.60^{c}\pm0.07$	$0.52^{b}\pm0.06$	$0.50^{b}\pm0.07$

Table 3

Effect of gooseberry on physico-chemical properties of raw and cooked mutton rolls. (n=6)

Parameters	Treatments				
	Raw meat rolls				
	C_1	C_2	T_1	T_2	T_3
pH	$6.11^{b}\pm0.08$	$6.08^{b}\pm0.06$	$5.81^{a}\pm0.06$	$5.83^{a}\pm0.09$	$5.86^{a}\pm0.09$
TBARS (mg malonaldehyde/kg)	$0.35^{d}\pm0.020$	$0.27^{c}\pm0.010$	$0.20^{b}\pm0.009$	$0.19^{ab}\pm0.010$	$0.18^{a}\pm0.008$
WHC (%)	$42.51^{a}\pm0.65$	$42.33^{a}\pm1.01$	$44.59^{c}\pm0.34$	$43.79^{b}\pm0.86$	$43.29^{b}\pm0.91$
Emulsion Stability (%)	$86.12^{a}\pm1.52$	$88.89^{b}\pm1.49$	$88.99^{b}\pm1.32$	$86.35^{a}\pm2.01$	$90.50^{c}\pm1.12$
	Cooked meat rolls				
pH	$6.20^{c}\pm0.01$	$6.19^{c}\pm0.01$	$5.90^{a}\pm0.04$	$5.90^{a}\pm0.03$	$6.00^{b}\pm0.01$
TBARS (mg malonaldehyde/kg)	$0.71^{d}\pm0.021$	$0.55^{c}\pm0.017$	$0.41^{b}\pm0.009$	$0.39^{a}\pm0.008$	$0.38^{a}\pm0.007$
Cooking yield (%)	$84.11^{a}\pm1.22$	$84.25^{a}\pm1.15$	$88.70^{d}\pm0.98$	$85.60^{b}\pm1.29$	$87.36^{c}\pm0.99$
Firmness	$0.64^{a}\pm0.002$	$0.66^{a}\pm0.070$	$1.27^{d}\pm0.015$	$0.83^{b}\pm0.002$	$1.05^{c}\pm0.030$
Toughness	$7.01^{b}\pm0.02$	$6.39^{a}\pm0.02$	$10.50^{e}\pm0.21$	$7.82^{c}\pm0.04$	$9.63^{d}\pm0.03$

Means ± SE with different small letter superscripts row wise differ significantly ($p\leq0.05$).
C_1: Control-Meat rolls without BHT and gooseberry, C_2: Positive control-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.

control and these results were in close agreement with the observations reported by Najeeb *et al.* (2014).

The percent protein content, in raw emulsion was statistically comparable with addition of gooseberry ethanolic extract but found significantly lower in gooseberry powders and its aqueous extracts as compared to control and BHT.

The protein content of mutton rolls added with gooseberry powder and gooseberry aqueous extracts treatments was statistically lower than controls and gooseberry ethanolic extract treatment. Similar results were reported by Najeeb *et al.* (2014) with incorporation of tomato paste and gooseberry in meat products, respectively.

The percent fat content in emulsion significantly decreased with addition of gooseberry powders, gooseberry aqueous extract, and BHT as compared to control. The fat replacing properties of dietary fiber decreased the fat content in mutton emulsion.

There was no significant difference in percent fat content of BHT, gooseberry powder and its aqueous and ethanolic extracts as compared to control in cooked rolls. These results were in close agreement with the observations reported by Najeeb *et al.* (2014) in gooseberry and red grapes treated meat product.

The percent ash content was increased insignificantly in treated emulsions and cooked rolls as compared to control and BHT. It might be due to high inorganic content in gooseberry treated rolls (Sa'yago-Ayerdi *et al.*, 2009).

Addition of gooseberry aqueous and ethanolic extract increased the fiber content significantly and it was recorded highest in red grape powder added cooked mutton rolls due to higher fiber content present in gooseberry (Sa'yago-Ayerdi *et al.*, 2009).

Physico-chemical properties of raw and cooked rolls:

Gooseberry treated mutton emulsion and cooked rolls showed significantly lower pH and TBARS values as compared to BHT treated and control samples (Table 3).It might be because of presence of acidic total phenols such as gallic acid in gooseberry which lowered the pH and TBARS values. The similar results were documented by Najeeb *et al.* (2014) in restructured chicken slice with incorporation of gooseberry and red grapes powder.

The percent water holding capacities increased significantly with gooseberry treatments and addition of gooseberry powder showed highest WHC. It might be due to increase in fiber content in directly powders added mutton emulsions (Sa'yago-Ayerdi *et al.*, 2009). However, the percent emulsion stability was recorded highest with addition of gooseberry ethanolic extract and could be due to an increase in viscosity of meat batter on addition of fiber source which resulted in an increased elasticity to emulsion based products. Similar observations have previously been reported by Choi *et al.* (2009).

The percent cooking yield significantly increased with addition of gooseberry in mutton rolls as compared to both the controls. Higher dietary fiber content in gooseberry powders added mutton rolls causing increased cooking yield due to water-holding and fat binding properties. Najeeb *et al.* (2014) also reported that fiber may generate technological properties that improve physicochemical and sensory properties.

Firmness and toughness were recorded significantly higher for all treated products than control. Gooseberry powder incorporation showed highest firmness and toughness followed by gooseberry ethanolic extract, aqueous extract and BHT in descending order. Higher shear force value as firmness and toughness of gooseberry powder added meatrolls might be due to high fiber content which resulted increase in hardness. Chang and Carpenter (1997) explained that fiber particles strengthened the protein matrix causing in a firm texture.

CONCLUSION

It was concluded that incorporation of gooseberry powder (1%) and its aqueous and ethanolic extracts(10% each), individually, lowered the protein content, pH and TBARS Value, and increased the moisture, ash and fiber contents, with improved emulsion stability, firmness and toughness, cooking yield and water holding capacity in developed functional mutton rolls.

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