

QUALITY CHARACTERISTICS OF BUFFALO VEAL ROLLS INCORPORATED WITH ALOE VERA GEL AND ARJUNA TREE BARK EXTRACT

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ABSTRACT

The study was conducted with an objective to evaluate the effect of Aloe vera gel (*Aloe barbadensis*) and Arjun tree (*Terminalia arjuna*) bark extract on quality characteristics of buffalo veal rolls. The buffalo veal rolls were prepared with incorporation of 4% Aloe vera gel (T₁) and 2% Arjun tree bark extract (T₂) and the nutritional and physico-chemical characteristics of the products were studied. Aloe vera gel addition showed significantly higher moisture and lower fat content as compared to control as well as T₂ rolls. The incorporation of Aloe vera gel and Arjun tree bark extract also decreased the cholesterol and free fatty acid content as compared to control samples. However, the emulsion stability and cooking yield of T₂ rolls were statistically comparable with control samples but these were higher in T₁ rolls. The addition of both Aloe vera gel and Arjun tree bark extract in the products resulted lower thiobarbituric acid content as compared to control product. The pH values were not affected by T₁ and T₂ treatments. The shear press value was lower for T₁ rolls and higher for the T₂ rolls as compared to the control. It is concluded that addition of Arjun tree bark extract at 2% and Aloe Vera gel at 4% levels improved the nutritional and physico-chemical properties of buffalo male calf meat rolls.

Key words: Aloe vera gel, Arjuna tree bark extract, Buffalo veal roll, quality

Indian farmers suffer huge loss (about US\$ 11 million per annum) in terms of high mortality rate (80 to 84.69%) of buffalo male calf due to poor care practices (FAO, 2014), however, it has a great potential for delivering important nutrients like quality proteins, minerals and vitamins. While food has long been used to improve health, our knowledge of health is now being used to improve foods. The understanding of relationship between nutrition and health has resulted in the development of concept of designer foods (Bhat and Bhat, 2011). Consumption of saturated fat, excess salt and calories in processed meat has been related to incidence of a number of diseases (Micha *et al.*, 2010).

Aloe vera gel in diet is known to regulating blood pressure, improving circulation of the blood, lowering cholesterol, and making blood less sticky, may be able to help lower the risk of heart disease (Lawless and Allen, 2000). Ahmad *et al.* (1993) reported the antioxidants, antibacterial, antifungal and even antiviral properties of aloe vera gel. Arjun tree is also traditionally used for several medicinal purposes in India and the bark of this plant is known to contain crystalline compounds, arjunine, a lactone, arjunetin and essential oils which act as natural antioxidants (Javed *et al.*, 2016). There has been much interest recently in the antioxidant and biological activity of polysaccharides, which is greater and more diverse

than previously realized. Hence, this study was conducted to evaluate the nutritional and physico-chemical qualities of buffalo veal rolls incorporated with aloe vera gel and arjun tree bark extract.

MATERIALS AND METHODS

Buffalo male calves' meat (10-12 months old) was procured from local meat market of Hisar city, Haryana. Aloe vera leaf and Arjun tree bark was collected from the CCS Haryana Agricultural University, Hisar campus. All chemicals utilized for evaluation of the quality characteristics of the products were procured from Himedia Laboratories Pvt. Ltd., India.

Fresh aloe vera leaves were washed and cleaned with muslin cloth properly. Crude gel was taken out by scrapping with plastic spatula after opening the leaves with the stainless steel knife. The gel was kept under refrigeration. Arjun tree bark was shade dried for 7 days followed by drying in a hot air oven at 45±2°C for 12 h. The bark was ground to a fine powder and 10 g powder was dissolved in 90 ml of 80 % ethyl alcohol and kept in the orbital shaker for 3 h followed by incubation at 37±1°C for 72 h. The alcoholic extract was filtered and filtrate was dried in hot air oven drier for 12-14 h till a final pasty consistency with 50±1% yield was obtained (Bishnoi and Ahlawat, 2015).

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Buffalo calf meat was washed thoroughly with warm water spray and deboned manually after trimming of fat and connective tissue. Deboned meat was frozen for 24 h and then minced in an electrical meat mincer (Mado Primus, MEW 613) and used for preparation of rolls. Control (C) rolls contained sodium chloride (2.5%), sodium tripolyphosphate (0.5%), sodium nitrite (150 ppm), spice mix (2%), condiments paste (3%) and sunflower oil (3%). The treatment (T_1) consisted of aloe vera gel (4%) and treatment (T_2) arjun tree bark extract (ATBE; 2%) in addition to control meat roll ingredients. Thoroughly mixed emulsion was stuffed in autoclavable beakers and steam cooked for 40 min, cooled to room temperature, packaged in polythene bags and stored at refrigerated ($4\pm 2^\circ\text{C}$) temperature for further studies. The ingredients used for preparation of different rolls have been mentioned in Table 1.

Per cent moisture, protein, fat and ash were estimated as per methods of AOAC (2005). Free fatty acids were determined by following the standard procedures (Konieko, 1979) and the per cent carbohydrate content was estimated by calculation method. Total lipids from sample were extracted (Angelo *et al.*, 1987) for evaluation of cholesterol content by following the principle that the cholesterol in glacial acetic acid gives a red colour with ferric chloride and conc. sulphuric acid. Weight of meat rolls before and after cooking was recorded and yield was calculated and expressed in per cent. Per cent emulsion stability was estimated by standard method (Baliga and Madaiah, 1970) and the pH of the products was evaluated by following the method of Trout *et al.* (1992) using a digital pH meter of (Oakton Instruments, USA).

Table 1
Ingredients used for preparation of buffalo meat rolls

Ingredients	Control (g; C)	Aloevera gel supplemented rolls (g; T_1)	Arjuna tree bark extract supplemented rolls (g; T_2)
Meat	76.0	76.0	76.0
Sodium chloride	2.5	2.5	2.5
STPP	0.5	0.5	0.5
Spice mix	2.0	2.0	2.0
Condiments (Onion:Garlic) 2:1	3.0	3.0	3.0
Sunflower Oil	3.0	3.0	3.0
Water	10.0	10.0	10.0
Sodium nitrite	0.02	0.02	0.02
Semolina	3.0	3.0	3.0
Aloe vera gel	0	4.0	0
Arjun bark extract	0	0	2.0
Total Qty	100.02	104.02	102.02

The TBA value was determined by following the method outlined by Witte *et al.* (1970) and expressed in mg malonaldehyde/kg. Shear press value of cooked meat rolls was analyzed 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 shear press value was performed as per the procedure outlined by Bourne (1978). Samples of 2cm x2cm x2cm were compressed to 50% of their original height. A time of 5 s was allowed to elapse between the two compression cycles. Force time deformation curves were obtained with a 50 kg load cell applied at a cross-head speed of 2 mm/s. Force required to shear a 1cm³ thick sample transversely was expressed in Newton (N).

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 the statistical analysis using SPSS MAC, version 22.0, SPSS Chicago (USA).

RESULTS AND DISCUSSION

Per cent moisture content of control buffalo veal rolls was significantly ($p\leq 0.05$) increased with addition of 4% aloe vera gel (Table 2). It was due to hydrophilic nature of aloe vera gel constituents. Soltanizadeh and Ghiasi-Esfahani (2015) reported that incorporation of aloe vera in low fat beef burgers improved moisture retention. However, the moisture content decreased non-significantly ($p\leq 0.05$) with addition of 2% ATBE, as compared to control. It might be due to very low moisture content in T_2 sample than meat as the bark was dried before extraction (Singh *et al.*, 2010).

Protein content decreased significantly ($p\leq 0.05$) in T_1 as compared to both control and T_2 treated meat rolls and it was due to a proportionate moisture content increase in T_1 . Moreover, the protein content in aloe vera was reported to be negligible by Shahzad *et al.* (2009). No significant ($p\leq 0.05$) difference in fat content was recorded between control and T_2 treatment meat rolls, but T_1 samples showed significantly lower fat content and it was due to comparatively lower fat absorption capacity of aloe vera gel as reported by Soltanizadeh and Ghiasi-Esfahani (2015).

Free fatty acids are the products of enzymatic or microbial degradation (lipolysis) of lipids and determination of FFA gives information about stability of fat and quality of product. The per cent FFA values were used as indices to assess the level of lipid oxidation in cooked buffalo veal rolls. The control samples had significantly ($p\leq 0.05$)

Table 2
Proximate composition of developed buffalo veal rolls
Means±SD, (n=6)

Parameters (%)	Control (C)	Treatment	
		T ₁	T ₂
Moisture	64.38 ^a ±1.27	67.31 ^b ±1.54	63.69 ^a ±1.21
Protein	17.76 ^b ±0.28	16.28 ^a ±0.17	17.71 ^b ±0.36
Fat	6.85 ^a ±0.13	6.55 ^b ±0.17	6.75 ^a ±0.20
Ash	3.46 ^b ±0.07	3.35 ^a ±0.04	3.98 ^c ±0.06
FFA	0.25 ^b ±0.004	0.20 ^a ±0.002	0.22 ^a ±0.005
CHO	7.55 ^b ±0.18	6.51 ^a ±0.21	7.87 ^b ±0.16
Cholesterol (mg/100g)	94.11 ^b ±2.97	82.87 ^a ±1.83	80.26 ^a ±1.31

With different small letters superscripts row wise differ significantly (p≤0.05). C=Control; T₁=4% Aloe vera gel, T₂=2% Arjuna tree bark extract

higher free fatty acid than both the treated (T₁ and T₂) products. This could be attributed due to release of more free fatty acids from higher fat containing control meat rolls. The lower free fatty acid content in T₁ and T₂ treatment meat rolls was due to strong antioxidant activity of respective constituents present in aloe vera and arjun bark, respectively, which provided oxidative stability to the fat in both the treated samples (Hu *et al.*, 2003; Ghani, 2003). Further, the overall lower fat contents of treated meat roll samples contributed to lower cholesterol content as compared to control samples.

The cooking yield of T₁ meat rolls was significantly (p≤0.05) higher than that of control as well as T₂ (Table 3). The highest moisture content retaining capacity in T₁ products contributed to the higher cooking yield (Kashyap *et al.*, 2012).

A significant increase (p≤0.05) in per cent emulsion stability was observed in T₁ emulsions as compared to control and T₂ meat rolls. Increase in viscosity of meat batter in T₁ samples resulting in increased elasticity to emulsion based products (Choi *et al.*, 2008). Slightly lower pH of T₁ product was due to lower pH (4.5) of aloe vera gel (Shahzad *et al.*, 2009) and the slight increase in pH of T₂ treated meat rolls was due to alkaline pH (7.55) of Arjun bark (Bachheti *et al.*, 2012).

Table 3
Physico-chemical properties of developed buffalo male calf meat rolls. Means±SD, (n=6)

Parameters	Control (C)	Treatment	
		T ₁	T ₂
Cooking yield (%)	84.58 ^a ±1.29	90.42 ^b ±1.47	83.04 ^a ±1.19
Emulsion stability (%)	89.36 ^a ±1.39	91.78 ^b ±0.99	87.74 ^a ±1.53
pH	6.09 ^a ±0.12	5.95 ^a ±0.16	6.12 ^a ±0.14
TBA value (mg malonaldehyde/kg)	0.57 ^b ±0.04	0.49 ^a ±0.03	0.48 ^a ±0.05
Shear press value (N)	0.89 ^b ±0.02	0.75 ^a ±0.01	1.13 ^c ±0.04

With different small letters superscripts row wise differ significantly (p≤0.05). C=Control; T₁=4% aloe vera gel; T₂=2% Arjun tree bark extract

An increase in TBA value is an indicator of the development of oxidative rancidity. A significantly (p≤0.05) higher TBA value of control meat rolls could be due to an initial higher fat content in control products resulting in more oxidative rancidity. The TBA value of buffalo veal roll was significantly decreased in T₁ and T₂ products. However, no significant difference was observed in between the treatments. Aloe vera gel and ATBE used for treatments showed their strong antioxidant properties (Zapata *et al.*, 2013; Shahriar *et al.*, 2012).

The lowest shear force value was noticed in T₁ buffalo veal rolls. Shear press value of the meat rolls in T₂ resulted in a significant increase (p≤0.05). The significantly lower force needed to shear in T₁ meat rolls might have resulted due to lower value of shear press and watery nature of aloe vera gel. Higher shear force value of T₂ meat rolls as compared to control might be due to increase in hardness as the bark particles might have strengthened the protein matrix resulting in a harder texture as compared to control (Chang and Carpenter, 1997).

It is concluded that incorporation of aloe vera gel and Arjun tree bark extract decreased the cholesterol, free fatty acid content, thiobarbituric acid content. However, aloe vera gel addition showed significantly higher moisture and lower fat content, increased tenderness, per cent emulsion stability and cooking yield as compared to control as well as Arjun tree bark extract added meat rolls.

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