EFFECT OF BLADE TENDERIZATION AND SODIUM BICARBONATE ON QUALITY OF SMOKED BUFFALO TRIPE PRODUCT

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ABSTRACT

A study was conducted to assess the quality and acceptability of smoked buffalo tripe product. Smoked buffalo tripe products were prepared from 3 times blade tenderized buffalo tripe with and without 2.5% sodium bicarbonate. Smoked buffalo tripe product prepared from non blade tenderized buffalo tripe without sodium bicarbonate was used as control. These were evaluated for various physico-chemical and sensory attributes. The results showed that smoked buffalo tripe products prepared with blade tenderization and 2.5% sodium bicarbonate were significantly higher for all physico-chemical characteristics followed by 3 times blade tenderized smoked products and control. Based on the results of sensory attributes, the score for appearance, flavour, juiciness, tenderness and overall palatability were significantly higher for 2.5% sodium bicarbonate treated smoked buffalo tripe products and were more acceptable than control and 3 times blade tenderized smoked buffalo tripe products. Therefore, 3 times blade tenderized buffalo tripe with 2.5% sodium bicarbonate could be successfully used for preparation of smoked buffalo tripe products.

Key words: Buffalo; Tripe; Blade tenderization; Sodium bicarbonate; Curing; Smoked product, Quality.

INTRODUCTION

Rumen meat, otherwise known as ‘tripe’ and colloquially called as ‘butt’, is one of the important edible offal of buffaloes. The yield of buffalo tripe ranges from 4.36 to 5.45 kg per animal. Buffalo tripe is one of the high proteinaceous by product obtainable from slaughter houses. Commercial exploitation of buffalo tripe for development of processed products is very limited because of its inherent toughness due to high collagen content, poor keeping quality and low aesthetic value. This material offers good scope for processing into manufactured product, subject to successfully overcoming these limitations by improvement of tenderness using suitable commercial technologies (Anna Anandh et al., 2008 ; 2009).

Cured smoked products are popular throughout the world. Curing and smoking are important processing techniques used primarily for pork and, to some extent also for beef or poultry (Paleari et al., 2000). Cured and smoked products have been much relished for their unique colour and flavour. The safety for consumption and shelf stability of such products has been proven over the years. Sodium bicarbonate is widely used as marinade in household cooking. Wang et al., (1991) reported that sodium bicarbonate improved tenderness of culled beef when it was used as tenderizer. In general, uniform penetration of chemicals has always posed problem during curing treatments. Blade tenderization is one of the most effective mechanical method of meat tenderization. Blade tenderization...
improves meat tenderness to a certain extent and opens up the structure of the meat and facilitates uniform penetration of tenderizer in meat (Devitre and Cunningham, 1985). Blade tenderization involves the penetration of meat by closely spaced blades with sharpened edges, which cut the muscle fibers into shorter segments (Benito-Delgado et al., 1994). Blade tenderization could be used to improve the quality characteristics of cured meat products (Kemp and Fox, 1985). Hence, a study was undertaken for development of technologies for converting the tough, less palatable and more perishable buffalo tripe into more tender, convenient and palatable smoked product by using blade tenderization and sodium bi carbonate.

**MATERIALS AND METHODS**

**Buffalo tripe (BT)**: Buffalo tripe was procured from local buffalo offals market of Bareilly city. It was cut into small chunks of 5 cm x 2.5 cm size. Before the tripe was made into chunks, the fat and adhering extraneous materials on the surface were removed by knife and deodorized by standardized procedure using 5% trisodium phosphate solution for 30 minutes (Anna Anandh et al., 2008). The blade tenderized BT chunks were sectioned into uniform pieces of about 2 – 3 cm and were used for the preparation of smoked buffalo tripe products.

**Curing ingredients**: Analytical grade chemicals viz. sodium nitrite, sodium tri-poly phosphate, sodium ascorbate and food grade commercial salt and sugar were used in the formulation of curing ingredients.

**Product preparation**: Based on the previous studies (Anna Anandh, 2007), 3 times blade tenderization and 2.5% sodium bi carbonate was selected for preparation of smoked buffalo tripe products. For each experiment, 250 gm of buffalo tripe chunks were used. The deodorized buffalo tripe chunks were blade tenderized 3 times by using mechanical blade tenderizer (Hobart, Germany) to open up the structure of buffalo tripe and facilitate uniform penetration of curing solution in to tripe chunks. The 3 times blade tenderized buffalo tripe chunks were immersed in curing solution consisting of 5.0% sodium chloride, 2.0% cane sugar, 0.5% sodium tripolyphosphate, 0.01% sodium ascorbate, 0.05% sodium nitrite and incorporated with 2.5% sodium bi carbonate. For control, 3 times blade tenderized and non blade tenderized buffalo tripe chunks were immersed in above standard curing solution without 2.5% sodium bi carbonate. All tripe chunks were immersed in curing solution in non-corrosive stainless steel containers for 12 hrs at 4 ± 2°C to facilitate equilibration. The buffalo tripe chunks were thoroughly mixed once in the curing solution by using a stainless steel striver after 6 hrs of chilling. After equilibration, the buffalo tripe chunks were drained off the curing solution and were smoked using 3 stage schedules in a automatic microprocessor smoke oven (Enviro-Pak, USA). Drying done for 30 min, smoking for 5 hr at 45°C to attain attractive and desirable brown colour and finally cooked to an internal temperature of 85 ± 2°C for 30 min to ensure proper cooking. After smoking, the smoked buffalo tripe products were evaluated for various physico-chemical and sensory parameters.

**Physico-chemical and sensory characteristics**

**pH**: The pH of minced buffalo tripe product was determined as per Trout et al. (1992). Homogenates were prepared by blending 10 g sample with 90 ml distilled water using an Ultra Turrax tissue homogenizer (Model T25, Janke and Kenkel, Germany) for 1 min. The pH of the homogenates was recorded by immersing combined glass electrode of digital pH meter (Century Instruments Ltd, India).

**Product yield**: The weight of smoked tripe products were recorded before smoking and after cooking and the yield was calculated (product yield = weight of smoked products / weight of raw products x 100) and expressed as percentage.

**Shear Force Value (SFV)**: Core of 1 cm² were taken from smoked buffalo tripe products after cooling at 4±2°C overnight and sheared using Warner Bratzler shear press (GR Elect. Mfg, Co.,
The force required to shear the sample was observed and recorded (Kg/cm$^3$). 10 observations were recorded for each sample to get the average value.

**Degree of curing (DC):** Quantification of nitroso and total pigments were performed according to the techniques of Hornsey (1956). The procedure is based on extraction of nitroso pigments from cured meat products with an acetone – water solvent with the inclusion of hydrochloric acid (Hcl).

For determination of cured pigments, smoked buffalo tripe products sample weighing 10 g was macerated for about 5 min under reduced light in a mortar and pestle by adding a solution containing 40 ml acetone and 3 ml distilled water. Then, the material was filtered through a Whatman filter paper no. 1. The optical density (OD) of the filtrate was measured at 540 nm against a blank solution containing 80% acetone and 20% distilled water. (Pearson and Tanber 1984) The OD was multiplied by a factor of 290 to obtain the nitroso haematin pigments in ppm.

For determination of total pigments, filtrate was prepared from 10 g of fresh BT as in the previous procedure, but with a solvent solution containing 40 ml acetone, 1 ml con. Hcl and 2 ml distilled water. OD was read at 640 nm against a blank containing 80% acetone, 2% con. Hcl and 18% distilled water. The OD was multiplied by a factor of 680 to obtain the total meat pigments in ppm.

Conversion of total pigments to cured pigments i.e. degree of curing (Pearson and Tauber, 1984) was determined by using the following formula.

Degree of curing (DC) = Nitroso pigments (ppm) / Total pigments (ppm) x 100.

**Proximate composition:** The moisture, protein and fat contents of smoked buffalo tripe products were determined by standard methods as per AOAC (1995).

**Sensory evaluation:** Sensory evaluation was conducted with semi-trained panelists. Slices, 10 mm thick from the smoked buffalo tripe products were served to the panelists. The sensory attributes like appearance and colour, flavour, juiciness, tenderness, binding and overall palatability were evaluated on 8 point descriptive scale (where 1 is extremely undesirable and 8 is extremely desirable).

**Statistical analysis:** The experiment was repeated four times. The data generated from each experiment were analyzed statistically by following standard procedures (Snedecor and Cochran, 1989) for comparing the means and to determine the effect of treatments.

**RESULTS AND DISCUSSION**

Physico-chemical parameters and sensory attributes of smoked buffalo tripe products prepared by 3 times blade tenderization + 2.5% sodium bi carbonate, 3 times blade tenderization without sodium bi carbonate and control (without blade tenderization and sodium bi carbonate) are presented in Table 1 and 2, respectively.

Physico-chemical and sensory characteristics:
Mean pH value was significantly ($p<0.01$) higher for sodium bi carbonate treated smoked buffalo tripe products as compared to 3 times blade tenderized smoked product and control. Higher pH values of sodium bi carbonate treated products might be due to alkaline nature of sodium bi carbonate. Sen et al, (2003) reported that 3% sodium bi carbonate increased pH up to 7.99. Sheard and Tali (2004) reported that sodium bi carbonate increased the pH of cooked pork loin. The mean pH values of smoked products of the present study were in agreement with report of Sofos et al. (1979) and Buchananan (1986) wherein they reported pH values of above 6.0 in cured and smoked products. Product yield value was significantly ($p<0.01$) higher in control followed by sodium bi carbonate treated products and 3 times blade tenderized smoked products. Lower product yield for 3 times blade tenderized smoked buffalo tripe products might be due to reduced water holding capacity. Davis et al. (1975) reported that blade tenderization decreased the cooking yield which
might be due to moisture loss through holes made by blade tenderizer. Sen et al (2003) and Wang et al (1991) reported that sodium bi carbonate treatment increased the cooking yield as compared to control. Shear force value was significantly (p<0.01) lower in sodium bi carbonate treated smoked buffalo tripe products as compared to 3 times blade tenderized smoked products control. This is indicated that 2.5% sodium bi carbonate after 3 times blade tenderization in curing solution were sufficient to cause tenderization. Degree of curing was significantly (p<0.01) higher for sodium bi carbonate treated and 3 times blade tenderized smoked buffalo tripe products as compared to control which might be due to combined effect of blade tenderization and sodium bi carbonate. Tyszkiewick et al. (1997) reported that blade tenderization caused appreciable increase of myofibrillar proteins by disruption of the contractile structure integrity. The increased availability of proteins facilitates curing reaction and thus might be responsible for increased degree of curing in treated buffalo tripe products.

Mean moisture, protein and fat content of control, 3 times blade tenderized and 2.5% sodium bi carbonate treated smoked buffalo tripe products followed by 3 times blade tenderized and control smoked products.

### Table 1: Effect of Blade Tenderization and Sodium bi carbonate on physico-chemical characteristics of smoked buffalo tripe products (Mean ± S.E).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>3 times blade tenderization</th>
<th>3 time blade tenderization + 2.5% Sodium bi carbonate</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.69 ± 0.02a</td>
<td>6.71 ± 0.03b</td>
<td>7.17 ± 0.04c</td>
</tr>
<tr>
<td>Product yield (%)</td>
<td>72.13 ± 0.52a</td>
<td>68.50 ± 0.62b</td>
<td>70.43 ± 0.82a</td>
</tr>
<tr>
<td>Shear force value(kg/cm²)</td>
<td>5.10 ± 0.07a</td>
<td>4.37 ± 0.33b</td>
<td>3.42 ± 0.07c</td>
</tr>
<tr>
<td>Degree of Curing (%)</td>
<td>26.86 ± 0.26a</td>
<td>33.17 ± 0.15b</td>
<td>42.57 ± 0.32c</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>65.12 ± 1.16</td>
<td>64.22 ± 1.66</td>
<td>65.72 ± 1.46</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>23.64 ± 0.10</td>
<td>23.68 ± 1.33</td>
<td>23.82 ± 0.28</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>2.54 ± 0.06</td>
<td>2.52 ± 0.10</td>
<td>2.57 ± 0.02</td>
</tr>
</tbody>
</table>

Mean bearing different superscripts row wise differ significantly (p<0.01).

### Table 2: Effect of Blade Tenderization and Sodium bi carbonate on sensory characteristics of smoked buffalo tripe products (Mean ± S.E).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>3 times blade tenderization</th>
<th>3 time blade tenderization + 2.5% Sodium bi carbonate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>5.2 ± 0.01a</td>
<td>5.3 ± 0.02a</td>
<td>6.4 ± 0.02b</td>
</tr>
<tr>
<td>Flavour</td>
<td>5.1 ± 0.01a</td>
<td>5.3 ± 0.01b</td>
<td>6.3 ± 0.01c</td>
</tr>
<tr>
<td>Juiciness</td>
<td>5.0 ± 0.01a</td>
<td>5.6 ± 0.01b</td>
<td>6.5 ± 0.02c</td>
</tr>
<tr>
<td>Tenderness</td>
<td>3.4 ± 0.01a</td>
<td>5.2 ± 0.01b</td>
<td>6.3 ± 0.01c</td>
</tr>
<tr>
<td>Overall palatability</td>
<td>4.9 ± 0.01a</td>
<td>5.4 ± 0.01b</td>
<td>6.6 ± 0.01c</td>
</tr>
</tbody>
</table>

** Based on a 8-point descriptive scale (where in 8 = extremely desirable; 1 = extremely undesirable).

Mean bearing different superscripts row wise differ significantly (p<0.01).
Sensory characteristics: Mean scores for appearance, flavour, juiciness, tenderness and overall palatability were significantly (P<0.01) higher for sodium bi carbonate treated smoked buffalo tripe products as compared to 3 times blade tenderized and control smoked buffalo tripe products. Becheral (1991) also reported that blade tenderization significantly improved tenderization without affecting other sensory attributes. Sen et al (2003) reported that sodium bi carbonate treatment improved the texture, juiciness and overall palatability scores compared to control in broiler meat. Improvement in sensory attributes of samples treated with sodium bi carbonate were also reported by Wang et al (1991) in culled beef and Sheard and Tali (2004) in cooked pork loin. Improvement in sensory attributes of smoked tripe products of the present study might be due to combined effect of blade tenderization and sodium bi carbonate.

CONCLUSIONS
Based on the results of physico-chemical parameters and sensory attributes, it can be concluded that smoked buffalo tripe products prepared with 2.5% sodium bi carbonate with 3 times blade tenderization were rated better in all sensory attributes and physico-chemical characteristics. Three times blade tenderization alone did not give any beneficial effect on quality and acceptability of smoked buffalo tripe products. Therefore, 3 times blade tenderized buffalo tripe with 2.5% sodium bi carbonate can be successfully used for preparation of smoked tripe products of acceptable quality with substantial value addition to the buffalo tripe.

REFERENCES