

PRELIMINARY STUDIES ON PROCESSING CHARACTERISTICS OF SMOKED DRIED BEEF (KUNDI) AT VARYING SALT LEVELS

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ABSTRACT

The semitendinosus muscle used for the study was excised from the wholesale beef round and trimmed of all surface fat and connective tissue and chilled for 24 hours. Sizeable pieces within a weight range of 70-90 grams were cut. For every 250g of meat, dry salt (NaCl) was rubbed into the meat at 10, 15 and 20% of the green weight. The salted meat pieces were left for 30 minutes to allow salt penetration.

Three treatments were applied cum; boiling of salted meat for 30 minutes until uniform doneness was achieved. The second treatment involved broiling in the oven for 30 minutes till uniform doneness was attained while the third treatment involved smoking of fresh salted meat samples without boiling or broiling.

The result showed that weight losses were considerable in all the treatments with increase in the salt levels although the results were not significantly different ($P>0.05$). It was also noted that although the shear force values obtained at the different salt levels were not significantly different ($p>0.05$), the values obtained increased as the weight loss increased. The addition of sodium chloride to meat was observed to cause a slight drop in the pH of meat.

Key words: Semitendinosus, broiling, boiling.

Short title: Preliminary studies on processing of beef at varying salt levels.

INTRODUCTION

Due to the high ambient temperature in the tropics, freshly slaughtered meat however hygienically handled and stored, does not keep for a very long time without some form of preservation. Raw meats are therefore, readily prone to invasion by spoilage organisms such as bacteria, moulds and yeasts. The growth of these spoilage organisms requires optimal conditions of temperature, water, air and substrate. Thus meat subjected to extreme heat or cold, deprivation of water and oxygen, excess of saltiness and increased acidity are bound to make conditions unfavourable for spoilage organisms to grow (Alonge, 1981).

In developing countries, especially Nigeria, the shortage of meat is not only due to scarcity of animals but also often due to spoilage (Alonge, 1987). Some locally

produced meat products like "kundi" (Yoruba) and "Banda" (Hausa), which are dried salted meat popularly produced in the far North where sunshine is more intense, have helped to address this problem since such products need no refrigeration. According to Zapata *et al.* (1990), appropriate technology for meat preservation must be relatively cheap, simple to use and be well adapted to the climate, social and economic conditions at the production areas. This study was then undertaken to evaluate the processing characteristics of smoked dried beef at varying salt levels.

MATERIALS AND METHODS

The beef used was purchased from the meat-processing abattoir of the Teaching and Research Farm of the University of Ibadan. The semitendinosus muscle used was excised from the wholesale beef and trimmed of all surface fat and connective tissue, and then chilled for 24 hours. The chilled meat samples were cut into sizeable pieces within a weight range of 70-90 grams. For every 250g of meat sample per treatment, dry salt (NaCl) was rubbed into the meat pieces at 10, 15 or 20% of the green weight. The salted meat pieces were left for 30 minutes to allow for sufficient penetration.

Treatment 1: Boiling

The chunks of salted meat from each salt level were separately boiled in 125 ml of water in a saucepan for 30 minutes with stirring at intervals for uniform doneness. The liquid broth was strained off, cooled and measured. The cooked meat was weighed to determine cooking loss. pH was measured with a pH meter. Boiled samples were spread in groups on a wire grill. Hardwood charcoal was used as fuel. The chunks were smoked for 2-3 hours at a stretch for each day. Smoking was for three consecutive days and then on alternate days till the seventh day when the pieces were sufficiently dried. Meat pieces were then placed in a square wooden box having a wire mesh cover to prevent flies, insects or rats from getting in. This was placed in an airy room for equilibrium with the environment. Changes in colour, size and weight of meat samples were noted. The room and the product temperatures were also taken during production.

Treatment 2: Broiling

Weighed fresh meat cuts were salted and placed in flat trays ready for broiling in the oven for 30 minutes at a temperature of 80-93°C. Meat pieces from each salt level were broiled. The cuts were allowed to stay for 15 minutes on each side for uniform doneness. After cooling, cooking loss was determined; other steps as in treatment 1 were also carried out ending with smoking and finally storing in the wire-meshed box.

Treatment 3: Raw

Fresh meat samples having the various levels of salt sufficiently rubbed into them were smoked directly without boiling or broiling for 2 hours at burning charcoal temperature. Other steps as in treatment 1 were followed. All treatments were replicated three times.

Smoke drying chamber

This consist of a 44- gallon oil drum split laterally into two halves. This was then mounted on four strong metal stands to support it. A thick wire mesh was placed horizontally across the length of this half drum. Smoking was effected by burning charcoal inside the drum and fanning it until the embers were red. Meat samples were then dried on this to impart the smokey flavour. The cured cuts were further smoked at 135-150°C for 3 hours.

Weight losses

Weights were obtained after smoking to obtain product yield. The smoking and cooking losses were determined using the formulae;

$$\text{Weight loss} = \frac{\text{initial weight} - \text{final weight}}{\text{Initial weight}} \times 100$$

Shear force measurement

A single core of 1.3cm diameter was taken from each chunk with the coring device along the fibre direction. Tenderness level was measured by shearing each core first at the center and again at the middle of each half core, using the Warner-Bratzler shearing device. The mean of these values was taken as the force necessary to shear the meat sample (Voisey, 1976).

pH Determination

The pH of raw, boiled and broiled samples were determined using a Jenco 6009 meter with temperature compensation and an Ionode IJ42 spear electrode (Safari et al., 2001).

Statistical Analysis

Data from parameters investigated were analyzed in a completely randomized design of statistical analysis system, SAS (SAS 1988).

RESULTS AND DISCUSSION

Weight losses

Table 1 shows the weight losses after smoking the meat samples obtained from the three treatments. The raw smoked samples at 10% salt level had 47.52% weight

loss while the boiled and broiled smoked at the same percent salt level had 55.8960.06% and 57.3360.02% respectively. However, these values were not significantly different ($p>0.05$) from each other. The percentage weight loss for the raw smoked samples at all salt levels were relatively lower than that of boiled and broiled samples probably due to the uncooked state of the samples since the meat pieces still held on to the moisture in the muscles.

Table 1: Weight losses after smoking and shear force values of smoked meat samples.

Salt levels	Boiled smoked	Broiled smoked	Raw smoked
	Weight losses (%)		
10%	55.89 ± 0.06	57.33 ± 0.02	47.52 ± 0.08
15%	62.28 ± 0.15	59.57 ± 0.05	49.63 ± 0.05
20%	61.60 ± 0.02	59.80 ± 0.11	58.03 ± 0.20
Shear force values			
10%	6.76 ± 0.11	10.00 ± 0.31	8.89 ± 0.11
15%	8.61 ± 0.73	7.30 ± 0.34	8.70 ± 0.11
20%	12.74 ± 0.60	6.50 ± 0.40	9.22 ± 0.32

^{ab}Means with the same superscripts are not significantly different ($p>0.05$).

Table 2: pH of meat samples at varying salt levels

Salt level	Freshly salted	Boiled salted	Broiled salted
10%	5.03 ± 0.06	5.13 ± 0.23	5.47 ± 0.84
15%	5.17 ± 0.06	5.50 ± 0.95	4.93 ± 0.25
20%	5.30 ± 0.30	5.40 ± 0.46	4.83 ± 0.25

*pH of meat used ; 5.6-5.8.

Mean values with similar superscripts are not significantly different ($P>0.05$).

Results obtained in this work showed that there were considerable losses in weight during processing with increased salt levels under the different treatments. Dehydration occurs as a result of moisture being withdrawn from meat that is salted. As the salt penetrates the meat, the water activity within the cut was reduced, making it less prone to spoilage. Adjusting the atmospheric humidity and air speed helps maintain the drying process.

Objective Measurements

Table 1 shows the values obtained for tenderness with the Warner- Bratzler shear device. In the boiled smoked samples, an increasing trend in the shear force was

observed from 10% salt inclusion (6.76kg/cm³) to 20% level of inclusion (12.74kg/cm³). However, a decreasing trend was observed for the broiled smoked samples from 10% level of salt inclusion 10.00cm³ to 6.50/gcm³ for 20% salt level.

Although the result obtained showed no significant shear force values of treatment at differing salt levels, the trend obtained however increased as the weight losses increased. The high shear force obtained in this study might probably be due to the fact that the samples were not rehydrated prior to shear value determination.

pH of the Different Treatments

The meat from freshly slaughtered cattle had an average initial pH of 6.5- 6.8 (Thornton and Gracey, 1974). It is therefore slightly acidic. Within 48 hours of slaughter, pH falls rapidly reaching its lowest value of 5.6- 5.8. As stated by Bryne *et al.* (2000), the pH of the meat tissue is widely used as a means of monitoring meat quality. The highest pH of 5.50 was observed in the boiled salted meat at 15% level of salt inclusion while the least pH value of 4.83 was obtained in the broiled salted meat samples at 20% level of salt inclusion. The addition of sodium chloride to meat causes slight drop in the pH of meat as observed for all samples. Heat is generally observed to raise the pH value in cooked meat. Table 2 shows the pH of freshly salted meat to increase with increasing salt levels. Even though boiling and broiling at each salt level showed an increase in pH, the trend was not predictable.

CONCLUSION

The present study tried to evaluate how the treatments employed enhances the quality of dried beef products. Partial boiling of the meat before smoke drying is the common practice but this study has shown that broiling reduced weight losses and reduced the hydrogen ion concentration with increasing salt levels. However, since no significant differences existed between treatments at different salt levels, any of the treatments could be employed. The keeping quality of the raw smoked samples is what disqualifies it from being used as a processing technique.

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