Meat Characteristics of Scalded, Singed and Conventionally Dressed Rabbit Carcasses

A.B. Omojola and A.O.K. Adesehinwa

Abstract: Thirty-six matured New Zealand rabbit were used to evaluate the effect of scalding, singeing and skinning on physico-chemical and organoleptic characteristics of rabbit meat. The rabbits were fed a concentrate diet containing 19.11% crude protein and 2541.30 Kcal ME/kg for a period of 28 days prior to slaughtering. The rabbits were stunned with a wooden club and killed in batches of three. Samples for pH and chemical analysis were taken from the Longissimus dorsi while the thigh muscles were used in evaluating the shear force values and organoleptic properties of the meat. The internal temperature and pH values were taken at a dept of 1 cm at the Longissimus dorsi immediately after dressing and subsequently at 30 min interval over a period of 4 h post-mortem. Dressing percentage, water-holding capacity, drip loss and cooking loss were also evaluated. The result showed that, the dressing percentage was higher (p<0.05) in scalded and singed carcasses. Cooking loss was not affected (p>0.05) by the dressing method employed. Singeing imposed a higher degree of toughness on rabbit meat while in a similar way, the drip loss was highest (p<0.05) in singed carcass with the least value recorded in the conventionally dressed rabbit meat. The water holding capacity was however least (p<0.05) in the singed carcass. The moisture and the fat were affected (p>0.05) by the dressing methods while the crude protein and ash were not affected (p>0.05) significantly. Singeing imposed a 15.71°C temperature differential on the longissimus muscle post dressing above that from the conventional dressing and a temperature differential of 14.12°C on the scalded carcass. Colour and flavour were significantly improved by singeing while tenderness was reduced. Juiciness and the overall acceptability were however, not affected (p>0.05) by the three dressing methods.

Key words: Singeing • scalding • skinning • organoleptic traits • rabbit meat

INTRODUCTION

Production, processing and consumption of meat are of tremendous economic, social, ecological and even political importance. However, the overall acceptability of meat is dependent on its general qualities. These qualities which can be both physical and chemical depend on a lot of factors, such as the pre and post slaughter conditions of the animal. The pre-slaughter conditions can be controlled to a reasonable extent while the understanding of the effects of the post-slaughter conditions on meat qualities will help in the assurance of consistent eating quality needed for the meat market to grow and become economically viable.

The reasons for variability of meat quality are many, right along the production chain into the processing plant, in retail outlets and even in the purchaser’s home. Paramount among all the post-slaughter processing of meat known to affect the eating quality and organoleptic properties is the dressing method employed. Previous report by Hamm [1] and Claus et al. [2] showed that post-mortem handling of meat carcasses affect to a larger extent the quality traits of the meat. The dressing method employed, such as singeing, which is a method widely practiced in the home for processing of stocks like goats, sheep, grass cutter and rabbits is a source variability of the meat quality. Its use in South Asia in dressing pork carcasses was documented by Stouffer [3]. Singeing is not limited to the aforementioned animal species alone, its use has also been extended to the processing of large animals such as cattle carcasses, horse and camels because it is easier and saves considerable time and energy relative to scalding and the conventionally dressing method of skinning [4].

These methods will not only affect the temperature and its rate of decline but will also affect the ultimate pH and other meat characteristics. In this present study therefore, investigations of the effects of singeing, scalding and skinning on yield (dressing percentage), pH, water holding capacity, chemical composition and other meat characteristics are reported.

MATERIALS AND METHODS

Thirty-six mature New Zealand rabbit with an average weight of 2.15±0.86 were used for the study. The rabbits were fed a concentrate diet containing 19.11 percent crude protein...
and 2541.30 Kcal / kg metabolisable energy for a period of four weeks prior to slaughtering. The animals were randomly allotted to the three dressing methods viz scalding, singeing and skinning. Each treatment composed of twelve rabbits. The rabbits were stunned with a wooden club and killed in batches of three. They were bled by severing the carotid and the jugular veins before being processed.

**Dressing methods/procedures:**

**Scalding:** This was done by dipping the bled rabbits in hot water (85°C) for five seconds. The fur was scrapped off with a hand metal scraper designed for the purpose until the carcass was clean. The scraping of the fur was completed within three minutes. The scalded carcass was eviscerated, washed and drained before the weight was recorded.

**Singeing:** The hair was flamed off over burning firewood with subsequent removal of the legs and head.

**Skinning:** The pelts of the slaughtered rabbits were removed with sharp scalpel and scissors. The scalpel was used in making a ring round one of the hind legs just above the hock. A scalpel was inserted under the skin of the leg to open it up to the root of the tail. The same was repeated with the other leg. From the pelvic region, another incision was made up to the neck region. The pelts was pulled along with the skin. The carcasses were washed and eviscerated. The warm carcass weight and dressing percentages were determined before other parameters were taken as follows:

**Shear force measurement:** Tenderness score was measured on samples from the thigh muscle using a Warner Bratzler shear force device.

**Temperatures:** The internal temperature were measured at a dept of 1 cm at the *longissimus dorsi* immediately after dressing (0 h post-mortem) and subsequently at 30 min interval over a period of 4 h post-mortem.

**Water holding capacity:** This was determined in triplicate by the press method [5] as modified by Tsai and Ockerman [6]. Approximately 0.5 g of sample was weighed onto a 9 cm whatman No 1 filter paper (Model C, Carver, Inc, Wabash, IN, USA) and pressed between two 10.2×10.2 cm plexi glasses at approximately 35.2 kg/cm² for 1 min. The area of free water was measured using a compensatory planimeter (Planix 5000, Tamaya Technics, Inc, Tokyo, Japan) and percent free water was calculated based on sample weight and moisture content [6]. Percent bound water (WHC) was calculated as 100% minus free water %.

**Cooking loss:** Approximately 5 g meat samples from each treatment group was weighed, wrapped in airtight polythene bag and cooked for 10 min. The water released after cooking and cooling was manually separated and the weight of the cooked meat taken.

\[
\text{Cooking loss} = \frac{\text{Weight of sample before cooking} - \text{Weight after cooking}}{\text{Weight before cooking}} \times 100
\]

**Drip loss:** This was measured by the method of Barton-Gade *et al.* [7] with some modifications. Chops from the tigh muscle were weighed immediately after cutting, hung in a laminate bag, closed tightly with string. The meat samples were weighed again after 6 days at 4°C and the drip loss calculated.

**Taste panel evaluations:** A total of twelve trained individuals were used.

The panelists were male (n=7) and female (n=5) and ranged in age from 30-35 years. These panelists were randomly allocated to the three treatments. The panelists were made to rate each of the 4 replicate of the meat samples. Equal bite size from each treatment were coded and served in an odourless plastic container. Each sample was evaluated independent of the other. The panelist rated the sample on a 9-point hedonic scale for colour, flavour, tenderness, juiciness and overall acceptability.

**Chemical composition:** Proximate analysis was carried out on meat from the *Longissimus dorsi* on one side of the loin. Total moisture content was measured by weight difference after drying. Fat, protein and ash were determined according to the method described by AOAC [8]. For pH measurement, 10 g of ground meat sample was homogenized in 100 mL of deionized water. The pH was measured with the MINISI pH meter, model 8000 at 0 h post-mortem and subsequently at 30 min interval over a period of 4 h post mortem.

All the data obtained were subjected to analysis of variance and where statistical significance was observed, the means were compared using the Duncan’s Multiple Range (DMR) test. The SAS Computer software package was used for all statistical analysis [9].

**RESULTS AND DISCUSSION**

The data on the various meat attributes of scalded, traditionally singed and conventionally dressed rabbit carcasses and other information are shown in Table 1. Scalded and singeing significantly (p<0.05) elevated the dressing percentage from 52.79±1.16 observed on the conventionally dressed to 55.32±2.02 and 57.79±1.66, respectively. The increased in the
Table 1: Characteristics of scalded, singed and conventionally dressed rabbit carcasses

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Scalding</th>
<th>Singeing</th>
<th>Skinning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live wt. (kg)</td>
<td>2.10±0.65</td>
<td>2.20±0.14</td>
<td>2.15±0.10</td>
</tr>
<tr>
<td>Dressing (%)</td>
<td>55.32±2.08b</td>
<td>57.79±1.66a</td>
<td>52.79±1.16b</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>29.35±3.21</td>
<td>29.69±3.09</td>
<td>27.69±3.12</td>
</tr>
<tr>
<td>Water holding capacity (%)</td>
<td>66.97±2.54a</td>
<td>42.22±5.27b</td>
<td>61.29±3.19a</td>
</tr>
<tr>
<td>Shear force (kg/cm²)</td>
<td>4.26±0.41b</td>
<td>5.40±0.28a</td>
<td>3.19±0.61b</td>
</tr>
<tr>
<td>Drip loss (%)</td>
<td>5.65±1.51b</td>
<td>7.15±0.64a</td>
<td>5.64±0.42b</td>
</tr>
</tbody>
</table>

** Means in the same row with similar superscripts are not significantly (p>0.05) different.

Table 2: Chemical composition of rabbit meat as influenced by the dressing methods (g/100 g)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Scalding</th>
<th>Singeing</th>
<th>Skinning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>71.42±1.19a</td>
<td>65.93±1.28a</td>
<td>68.32±0.38a</td>
</tr>
<tr>
<td>Crude protein</td>
<td>20.64±0.54</td>
<td>19.43±2.63</td>
<td>21.05±2.03</td>
</tr>
<tr>
<td>Fat</td>
<td>3.58±0.52a</td>
<td>2.97±0.07a</td>
<td>1.49±0.15b</td>
</tr>
<tr>
<td>Ash</td>
<td>1.88±0.21</td>
<td>2.08±0.20</td>
<td>2.03±0.11</td>
</tr>
<tr>
<td>pH</td>
<td>6.07±0.12</td>
<td>6.31±0.09</td>
<td>5.99±0.03</td>
</tr>
<tr>
<td>T °C internal</td>
<td>33.70±0.48a</td>
<td>48.42±2.76a</td>
<td>32.71±0.60</td>
</tr>
</tbody>
</table>

** Means in the same row with similar superscripts are not significantly (p>0.05) different.

dressing and reduction in the percentage chilling loss of the scalded and singed carcasses were attributable to the added weight and protective effect of the skin, which was retained on the carcasses. This finding was in agreement with that of Okubanjo [4].

Shear force values obtained in the present study showed that meat from singed rabbit was tougher (p<0.05) while in a similar manner those of scalded rabbit were higher (p<0.05) than those of the conventionally skinned rabbit. Rigour shortening, especially during the first 24 h post-mortem is temperature dependent due to the temperature dependence of calcium released from the sarcoplasmic reticulum and such rigour shortening is very important to the ultimate meat tenderness [10, 11]. Thus, the rapid development of heat induced contraction and rigid setting of the various muscle fibre during singeing and scalding operation accounted for the observed toughening.

It is perhaps essential to distinguish between events during singeing and the previous observation of Cia and Marsh [12] that meat cooked in the pre-rigour phase was the most tender. The internal temperature of 48.42±2.76°C achieved at a depth of 1 cm in this study during singeing was well below the internal temperature of 58 to 60°C needed to cook meat to a rare state with most glycolytic enzymes inactive [13]. At the temperature achieved during singeing in this report, the activities of glycolytic enzymes were intact [14] and glycolysis would therefore continue till completion under subsequent chilling to ensure overall toughness of the muscle. Also, the high shear force recorded for the singed over the scalded could be due probably to the shortening and shrinkage of myofibrils by heat, whereas in the scalded, meat jelly formation and swelling of the connective tissue might have increased the tenderness by spacing out the muscle fibres [15].

The water holding capacity (WHC) was least (p<0.05) in the meat of singed carcasses while those of the scalded and skinned were statistically (p>0.05) similar (Table 1). The water holding capacity was reduced by thermal treatment. It is well known that protein denaturation and coagulation by heating reduce the space within the myofibrillar protein network with a consequence decrease of water [16] and lowering of the WHC [17]. The method of dressing employed did not affect the percent cooking loss significantly (p<0.05) while the drip loss was highest (p<0.05) in the singed carcass with a value of 7.15±0.64. It is generally accepted that the source of drip is intracellular water which is lost from the muscle fibre post-mortem, driven by a pH and calcium induced shrinkage of myofilbrils during rigour development [18, 19]. The rate and quality of drip formation in fresh meat is believed to be influenced by the extent of rigour, shrinkage and the permeability of the cell membrane to water as well as other factors, such as the extent of protein denaturation [20].

The initial pH at 0 h post-mortem was highest in the singed, followed by the scalded and least in the conventionally dressed carcass. Although the observed differences were not (p>0.05) significantly different, it is worth of note that a slight increase in pH will affect most of the meat attributes. The increase in pH values of the singed and scalded rabbit carcasses at 0 h post-mortem could be due to modification of electric charges of acid groups, separation of peptide chain and production of new components [15] or could be attributed to the fission of protein chain at labile linkages involving imidazole,-SH and OH groups, followed by hydrogen bonding between carboxyl and amino groups [21].

Singeing significantly (p<0.05) elevated the internal temperature from 32.71±0.60 and 33.70±0.48 recorded for skinning and scalding, respectively to 48.42±2.76°C at 0 h.
Table 3: Organoleptic characteristics of scalded, singed and conventionally dressed rabbit meat

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Scalding</th>
<th>Singeing</th>
<th>Skinning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>6.50±0.57a</td>
<td>6.20±0.53a</td>
<td>5.50±0.70</td>
</tr>
<tr>
<td>Flavour</td>
<td>5.30±0.63b</td>
<td>6.80±0.50a</td>
<td>5.80±0.51b</td>
</tr>
<tr>
<td>Tenderness</td>
<td>6.90±0.60a</td>
<td>4.90±0.75b</td>
<td>7.10±0.53a</td>
</tr>
<tr>
<td>Juiceness</td>
<td>6.10±0.48</td>
<td>5.80±0.68</td>
<td>6.20±0.59</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>5.80±0.71</td>
<td>6.50±0.48</td>
<td>6.20±0.48</td>
</tr>
</tbody>
</table>

Means in the same row with similar superscripts are not significantly (p>0.05) different.
*Rated on a nine point hedonic scale, Higher values indicates higher preference.

Fig. 1: Changes in internal temperature of dressed rabbit carcasses (time post-mortem)

Fig. 2: Changes in rabbit meat pH as influenced by dressing methods and time post-mortem

post-mortem. The result obtained in this study followed a similar trend reported by Okubanjo [4]. The internal temperature differential evened out as time post-mortem increased.

Mean for proximate analysis are shown in Table 2. The lower moisture (p<0.05) content obtained for singed carcasses could be as a result of some losses that occurred during the singeing operation. The crude protein and the ash content were not significantly (p>0.05) affected by the processing methods. However, a slight increase in ash content was noticed in the singed carcass. This observation could not be linked directly with the singeing process since the carcass was thoroughly washed and scraped with a scraper.

The lower (p<0.05) fat content obtained in the skinned carcass could be attributed to the removal of the skin with some of the under laying fat. Naturally, a degree of fat is laid beneath the skin of animals and when animals are processed by skinning, a lot of these fat layers will be removed. There was no
noticeable (p>0.05) difference in the fat content of the scalded and singed carcasses.

The sensory evaluation result indicated a lower (p<0.05) score for skinned rabbit meat in terms of colour while those of scalded and singed carcasses were rated equally (p>0.05). The implication is that the meat from the conventionally dressed (skinned) rabbit will be less acceptable since meat colour is the first criteria consumers use to judge meat quality and acceptability [22]. Colour is mainly influenced by the myoglobin (Mb) content and nature, the composition and physical state of muscle and the meat structure [23, 24].

The flavour rating was highest (p<0.05) in the singed carcass while there was no significant (p>0.05) difference between the scalded and skinned rabbit. The most probable reason is that singeing gives a smoky flavour to meat [4]. The panelist gave the least tenderness value (p<0.05) to the meat obtained from singed rabbit, similar to the shear force evaluation result. The same reason given for the shear force result was most probably responsible for the value obtained under the sensory evaluation score.

As shown in Table 3, there were no significant (p>0.05) difference in the juiciness score of meat from the three dressing methods. The least value obtained in the singed carcasses could be attributed to the slightly higher cooking loss and lower water holding capacity obtained from the same treatment in the present study.

The mean panel rating for overall acceptability is shown in Table 3. The result obtained revealed that irrespective of the dressing methods employed, the rabbit meat are equally (p>0.05) accepted by the panelist.

**CONCLUSIONS**

In conclusion, singeing of rabbit carcasses has remarkable effects on dressing percentages, water holding capacity and the drip loss. It also imposes a toughening effect on the meat while scalding increased the moisture and fat content of rabbit meat. The meat from singed carcasses was rated highest in terms of flavour while the overall acceptability of the rabbit meat was not dependent on the processing method employed.

**REFERENCES**


