Egypt. J. Vet. Sci. **Vol. 50,** No. 2, pp. 135-144 (2019)

Egyptian Journal of Veterinary Sciences
https://ejvs.journals.ekb.eg/

Effect of Different Dressing Methods on the Carcass Characteristics, Chemical Composition and Organoleptic Properties of Meat from Traditionally Managed West African Dwarf Sheep.

Yusuf A. Adeniji[1,2], Ibrahim A. Alhidary[2], and Akinkunmi J. Abidoye[1]

[1]*Federal University of Agriculture, Abeokuta, College of Animal Sciences and Livestock Production, Department of Animal Production and Health, Abeokuta, Nigeria.*

[2]*King Saud University, College of Food and Agriculture Sciences, Department of Animal Production, Riyadh, Saudi Arabia.*

THE WEST African Dwarf sheep meat is a common source of protein among rural dwellers in southwest Nigerian and is processed under different methods. These methods could affect the nutrient composition of meat and carcasses. To validate this hypothesis, a total of twenty-four traditionally managed West African Dwarf rams with average age of 18 months, weighing averagely between 15-19kg were used to evaluate the effect of scalding, skinning and singeing on carcass characteristics and proximate composition of meat from sheep. The animals were slaughtered after fasted for 16 hours but with access to clean-cool water by severing both the carotid artery and jugular veins. The empty body weight (EBW), hot carcass weight (HCW), dressing percentage (DP) and retail cuts were determined and meat samples from the flank were used for proximate analysis. The result showed that dressing percentage was higher ($p<0.05$) in scalded (51.84%) and singed (51.29%) carcasses. The weights of retail cuts differed ($p<0.05$) with dressing methods, scalding having the highest values. The dry matter (DM), fat and ash contents of meat were not affected by the dressing methods while crude protein differed ($p<0.05$). Color, juiciness and overall acceptability values for scalded carcass have higher ($p<0.05$) values whereas singed carcasses is superior ($p<0.05$) in terms of flavor compared to the other dressing methods. Cooking loss was greatest ($p<0.05$) for singed carcasses and considerably low ($p<0.05$) in scalded carcasses. These processing methods have significant effects on the overall acceptability to both the consumer and the butcher, while consumers reckon with the nutritive characteristics as well as color, tenderness and juiciness, the butcher will be more concerned with the dressing percentage of the carcasses.

Keywords: Scalding, Skinning, Singeing, Carcass characteristics, Proximate composition, Sensory evaluation.

Introduction

Good quality meat is in high demand in every part of the world, the nutrition of the animal, sex, age, handling and slaughtering method, processing of the animals, processing of the meat and carcasses all affects the quality and size of the meat from the sheep. The consumer attitude to meat shows preference depending on a criteria considered to be important [1], such criteria may include species, age at slaughter and eating quality of meat. [2], also stated that the quantity of meat consumed in developing countries largely depends on the price of meat in relation to individuals' income and meat availability. The overall acceptability of meat is dependent on its

Corresponding author: Yusuf A. Adeniji, emailsfadeniji@gmail.com, Tel, +68521671275
(*Received* 14/04/2019, *accepted* 23/07/2019)
DOI. 10.21608/ejvs.2019.11925.1075

general qualities. These qualities both physical and chemical depend on a lot of factors: 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 not only help in the assurance of consistent eating quality needed for the meat market to grow and become economically viable [3] but also assist mutton producers to adopt the processing method that will appeal to the consumer: in quality and best nutrient composition. This study therefore evaluates the effects of dressing methods namely scalding, singeing and skinning on the carcass characteristics and the chemical composition of meat from traditionally managed West African Dwarf sheep.

Materials and Methods

Animals and Management

Twenty-four traditionally managed West African Dwarf rams weighing an average of 15-19kg live weight and within an average of 18 months old determined using the dentition method of age determination, were purchased from rural areas of Odeda Local Government area of Ogun State, Nigeria.

Slaughtering Procedure

The animals were slaughtered following restraint and after being starved for 16 hours but with access to clean cool water without stunning. Bleeding of the animals was done by severing both the carotid arteries and jugular veins followed by copious exsanguination.

Dressing of Carcasses

The following processing treatments were carried out

Scalding: Carcasses were scalded by pouring hot water on the carcass for the hair to loosen and scraped off with a hand metal scrapper designed for the purpose or blade until the carcass is clean as described by Fasae et al. (2010)[4].

Skinning: The pelts of the carcasses in this group were removed with a sharp scalpel, knife and scissors. A ring was made round one of the hind legs and the knife was inserted under the skin of the leg to open it up, the same was done on the second leg. Another incision was made right from the pelvic up to the neck. The pelt was gradually pulled until it was removed as the procedure described by Omojola and Adesehinwa, (2006)[3].

Singeing: Hairs of carcasses in this group were flamed off over burning fire made with firewood until all the hairs had been carefully burnt off with minimal damage to the skin as described by Okubanjo, (1997)[5]. The carcasses were thoroughly washed and scrapped.

Carcass Characteristics

Carcass evaluation was carried out according to Adu and Brinckman (1981)[6] after slaughtering and evisceration. The empty body weight was computed by subtracting the weight of the gut content from the slaughter weight. The hot carcass weight was determined after removing the head, feet and gastric intestinal tract (GIT). The carcasses were cut into retail parts (shoulder, loin, legs, breast, neck, flank) and each part were weighed as described by Adu and Brinckman (1981)[6].

The intestinal guts of the carcasses were removed along with the visceral (heart, kidney, liver, lungs, spleen) weighed and recorded. The content of the gut was emptied to determine the empty gut weight. The dressing percentage was calculated and computed as the ratio of hot carcass weight (with or without) the inclusion skin to live weight in percentage.

Collection of Meat Samples

Twelve meat samples were collected by cutting with a sharp knife, from the flank of the animals after slaughtering, dressing and evisceration. The samples were labeled according to the three methods stated above (scalding, skinning and singeing).

Analysis of Samples

Chemical composition of samples of meat from sheep processed under skinning, scalding and singeing were determined by proximate analysis in the laboratory. Total moisture content/dry matter was measured by weight difference after drying in an oven. Fat, protein, dry matter and ash were determined according to the methods described by AOAC, (1990)[7].

Sensory evaluation

The sensory evaluation of the mutton was carried out as a means of estimating the meat's quality. Samples of mutton for the sensory evaluation were cut from the loin of each of the ram's carcass. It was carried out at the Animal Products and Processing Laboratory of the Department of Animal Production and Health, Federal University of Agriculture, Abeokuta.

This was conducted using a ten member taste panel according to the procedures of AMSA, (1995)[8]. Meat samples tested were coded after cooking for 30 minutes in labeled polythene bags placed in a water bath to a temperature of 65^{0}C. Bite size portions of the cooked mutton were served sequentially to the panelists on a clean stainless steel plate for them to comment freely on the samples served. They were provided with water for use in-between treatment evaluations, this was to ensure that there was no carry-over of taste from one sample to another. Meat sample from each treatment was evaluated independently of the other. The panelists rated the meat samples on a 9-point hedonic scale for colour, flavour, tenderness, juiciness and overall acceptability.

The 9- point Hedonic scale used is as follows:
9=like extremely, 8=like very much, 7=like moderately, 6=like slightly, 5=neither like or dislike, 4=dislike slightly, 3=dislike moderately, 2=dislike very much, 1=dislike extremely [9].

Cooking loss, which is the loss in weight during cooking occurring in form of drip thereby reducing the original weight of a meat sample, was determined by removing about 10g semi-membranous muscle from the thigh, wrapped in air-tight polythene bag and cooked in water for about 30 minutes on an electric hot plate. Cooking weight loss (CWL) was computed as:

pH determination

Samples for pH were taken at the *Longissimus dorsi* of each carcass after dressing. The meat samples were refrigerated for about 24 hours after which the pH was taken. 1g of ground meat sample was homogenized in 10ml of distilled water and the pH was measured with the ATC pH meter, model 2000.

Statistical Analysis

All the data obtained in the study were subjected to analysis of variance in a complete randomized design (CRD) using the statistical package [10]. Means were separated using Duncan's Multiple Range Test. [11].

Results

The carcass characteristics of traditionally managed West African dwarf sheep dressed by scalding, skinning and singeing are shown in Table 1. Carcass from skinned have the least dressing percentage of 46.69% while scalding and singeing significantly ($p<0.05$) have higher values of dressing percentage, 51.84% and 51.29% respectively.

From the present study it can be deduced that skin had a significant effect ($p<0.05$)on the weight of the retail cuts of carcass from scalding,

$$CWL = \frac{\text{Weight of meat before cooking} - \text{Weight of meat after cooking}}{\text{Weight of meat before cooking}} \times 100$$

TABLE 1. Carcass characteristics of traditionally managed West African dwarf sheep dressed by scalding, skinning and singeing.

Components	Dressing Methods			SEM
	Scalding	Skinning	Singeing	
Slaughter weight (kg)	17.14	17.11	16.43	0.44
Empty Body Weight (kg)	12.62	12.69	12.77	0.27
Hot Carcass Weight (kg)	8.87	8.00	8.48	0.32
Dressing Percentage (%)	51.84^a	46.69^b	51.29^a	1.04
Non-carcass components (g)				
Head***	22.87	25.62	27.77	1.36
Feet	6.94	5.64	6.84	0.30
Heart	0.09^a	0.05^b	0.09^a	0.01
Kidney	0.09^a	0.05^b	0.07^a	0.01
Lungs	0.25^b	0.29^{ab}	0.32^a	0.01
Spleen	0.05	0.05	0.05	0.00
Liver	0.38^a	0.44^a	0.27^b	0.03
Empty gut	0.68^a	0.70^a	0.46^b	0.04

^{ab} Mean values in the same row with the same letters did not differ significantly ($p>0.05$)

SEM – Standard Error of Means *** Percentage of slaughter weight and the decrease in weight in skinning was due to the removal of skin and minimal damage to the skin during singeing operation. The mean values of the hot carcass weight (HCW) and empty body weight (EBW) are statistically the same (p>0.05) but varies within the treatments. Hot carcass weights from the three treatments are statistically the same (p>0.05). The highest in scalded carcasses followed by singed carcasses and least in skinning. The HCW which was computed from the EBW after the removal of head and feet within 1hr of slaughter and processing according to Fasae et al. (2010)[4].

The weights of non-carcass components (Table 1) from the experimental sheep showed significant (p<0.05) differences among the treatments in the components monitored. There are no significant (p>0.05) differences in the Empty gut of carcasses in skinning and scalding while least values (p<0.05) exists between singed and the other two methods. There was no significant (p>0.05) difference in the mean weight values obtained for spleen, though the higher the weight of the animal, the higher the weights of the visceral. This indicated that the methods under study had no effect on the weight of this part. The uniform weight can be due to the insignificant (p>0.05) difference in the live weights of the animals. Also the values obtained for kidney, liver and heart were significantly (p<0.05) higher in scalding. These values are higher compared to that recorded by Makinde, (2002)[12] in West African dwarf sheep managed semi-intensively.

Table 2 showed the proportions in percentage of the empty body weight of retail cuts from WAD sheep subjected to the different processing methods. Significant differences (p<0.05) were recorded in the cuts from carcasses under the different processing methods. The proportions of the retail cuts were significantly (p<0.05) higher in scalded and singed carcasses compared to values obtained from skinned carcasses.

The values recorded for shank/flank and rib are significantly (p<0.05) different across the processing methods with highest values in scalded carcasses. There were no significant (p>0.05) differences in the loin region from carcasses in the three processing methods (scalding, skinning and singeing).

There exists significant (p<0.05) difference in the crude protein content of the experimental animals. Scalded and skinned carcasses differ significantly from singed carcasses in crude protein content. The range of 22.25 – 28.20 observed in this study, with scalding having the highest value of 28.20% followed by 28.13% in skinned carcasses and 22.25% in singed carcasses. The non-significant (p>0.05) difference observed in the fat, ash and dry matter composition of the meat from the flank (Table 3)indicates that the methods under study had no effects on the chemical parameters measured in these part.

The mean scores for the sensory evaluation of meat from scalded, skinned and singed WAD sheep are presented in Table 4. The sensory evaluation of WAD sheep's meat was greatly affected by the dressing method employed. The panelists scored meat from scalded carcasses higher (P<0.05) than meat from singed and skinned carcasses in colour.

The dressing methods did not affect (P>0.05) meat tenderness across the treatments. There was a significant (P<0.05) difference observed in the juiciness score for skinned and singed carcasses. Highest (P<0.05) score was observed in skinned carcasses (7.31) which ranked the same with

TABLE 2. Proportions in percentages of the Empty Body Weight of retail cuts from traditionally managed West African dwarf sheep dressed by scalding, skinning and singeing.

Components	Dressing Methods			SEM
	Scalding	Skinning	Singeing	
Neck	4.52^{ab}	4.20^{b}	4.80^{a}	0.11
Rib	13.12^{a}	11.35^{c}	12.10^{b}	0.25
Loin	9.77	8.90	8.84	0.36
Breast	3.33^{a}	2.18^{b}	2.94^{a}	0.16
Forelimb/Shoulder	12.93^{a}	10.76^{b}	13.76^{a}	0.29
Shank/Flank	26.22^{a}	25.56^{a}	22.95^{b}	0.58

^{ab} Mean values in the same row with different superscripts differ significantly (p<0.05)

SEM – Standard Error of Means

TABLE 3. Proximate composition (%) of meat from flank in traditionally managed West African dwarf sheep dressed by scalding, skinning and singeing.

Components	Dressing Methods			
	Scalding	Skinning	Singeing	SEM
Dry matter	29.14	28.37	26.86	1.42
Crude protein	28.20[a]	28.13[a]	22.25[b]	0.97
Fat	10.03	7.83	8.59	1.73
Ash	7.75	8.60	7.63	0.59

[ab] Mean values in the same row with the same letters did not differ significantly (p>0.05)
SEM – Standard Error of Means

TABLE 4. Mean values of the sensory evaluation of meat from loin region of Scalded, Skinned and Singed West African Dwarf sheep

Parameters	Dressing methods			
	Scalding	Skinning	Singeing	SEM
Colour	7.48[a]	7.09[b]	7.28[ab]	0.07
Flavour	7.20[b]	7.15[b]	7.55[a]	0.08
Juiciness	7.22[a]	7.31[a]	6.80[b]	0.08
Tenderness	7.52	7.58	7.38	0.07
Overall acceptability	7.66[a]	7.41[b]	7.49[b]	0.04
Cooking loss (%)	20.38[c]	22.41[b]	24.48[a]	0.73
pH	6.45	6.22	6.78	0.13

[a,b,c] Mean values in the same row with different superscripts are significantly (P<0.05) different. SEM – Standard Error of Means.

scalded meat with the lowest score reported for singed carcasses (6.80).

The results of overall acceptability showed that meat from scalded carcasses were preferred to meat from singed and skinned carcasses. Overall acceptability of skinned and singed carcasses ranked equal (P>0.05).

There was no significant (P>0.05) difference in the pH of the scalded, skinned and singed carcasses at 24 hours post-mortem. However, singed meat has the highest pH of 6.78 while 6.45 and 6.22 were recorded for scalded and skinned meat respectively.

Discussion

The increase in dressing percentage in scalded carcass and lowest value in skinned may be attributable to the effect of skin, which was present in scalded carcass but absent in skinned carcass. This finding was in agreement with that of Cassey and Van Niekrek, (1988)[13] and Okubanjo, (1997)[5] that dressing percentage (DP) can be influenced by many factors such as fleece and hide weight, alimentary tract size and fill, slaughtering procedures and the partitioning of the body fat, also DP is affected by degree of muscling. According to Devendra and Owen, (1983)[14]. Dressing percentage increases with age, this is because the young animals have higher proportions of offal in relation to carcass weight than old stock. The range of dressing percentage obtained from this study is within range of 48%, 52% and 55% reported by Mahgoub et al. (2000)[15], Kawas et al.(2007)[16] and Alkoiret et al. (2007)[17], respectively in some tropical sheep breeds. The dressing percentage observed for skinned sheep is close to the values reported by Adu (1982)[18] and Fasae et al. (2007)[19] for indigenous sheep. From the present study it can be deduced that skin had a significant effect ($p<0.05$) on the weight of the retail cuts of carcass from scalding, and the decrease in weight in skinning was due to the removal of skin and minimal damage to the skin during singeing operation. The mean values of the hot carcass weight (HCW) and empty body weight (EBW) are statistically the same ($p>0.05$) but varies within the treatments. This is so because the heat applied during singeing made the carcass to be compact and firm, this is believed to have contributed to the highest value for the empty body weight (EBW) though the animals in this treatment (singeing) have the lowest values for the live weight at slaughter owing to the fact that animals in scalding and skinning respectively have higher weights which is in proportion to the values of the empty gut 4.55 and 4.36 respectively.

There are no significant ($p>0.05$) differences in the Empty gut of carcasses in skinning and scalding while least values ($p<0.05$) exists between singed and the other two methods. This can be due in relation to the similar slaughter weights in scalding and skinning. Likewise the lowest value in empty gut of sheep in singeing might be due to the smaller weight, also the content of the GIT before the sheep were assigned to the treatments before starving could also lead to the variations in the data obtained. Also the management method the sheep are exposed to, the traditional method, have implications on the GIT content, this system is characterized with low feed intake which is proportional to the content of the GIT. There was no significant ($p>0.05$) difference in the mean weight values obtained for spleen, though the higher the weight of the animal, the higher the weights of the visceral. This indicated that the methods under study had no effect on the weight of this part. The uniform weight can be due to the insignificant ($p>0.05$) difference in the live weights of the animals. The empty gut is significantly higher in scalding and skinning and lowest in singeing. This could be attributed to nutrition and also the slaughter weight of the animals. Also the values obtained for kidney, liver and heart were significantly ($p<0.05$) higher in scalding. These values are higher compared to that recorded by Makinde, (2002)[12] in West African dwarf sheep managed semi-intensively. The values obtained for kidney and lungs are significantly the same ($p>0.05$) in singed and skinned carcasses while there is significant ($p<0.05$) differences in the values of the liver and heart. It can also be seen that the non-carcass components/EBW increased significantly with increasing carcass weight, this is not in accordance with that recorded by Pe˜na F. et al.(2005)[20] for segure˜na lambs, and this might be due to the difference in breeds.

The differences in weights of the cuts can be due to the corresponding differences in slaughter weight. The proportions of the retail cuts were significantly ($p<0.05$) higher in scalded and singed carcasses compared to values obtained from skinned carcasses. The close values recorded in scalded and singed carcasses were suggested to be due to the presence of skin. It was also observed from the study that the values obtained for singed carcasses were higher in the neck and forelimb/shoulder than values for scalded carcasses. The proportions of loin and shoulder are the same in scalding and singeing, this is in agreement with that proposed by Monin, (1995)[21]. The difference in loin is as a result of high ratio of bone to meat. Though they are statistically same, but scalding have highest mean value, followed by skinning and singeing. The least value for singeing might be as a result of heat damage to the bone, when bones are burnt, they tend to be lighter. The values recorded for shank/flank and rib are significantly ($p<0.05$) different across the processing methods with highest values in scalded carcasses. The rib has bone which when exposed to flame in singeing led to a reduction in the weight of this part, also the breast is observed to contain little fat which added to the weight in scalded carcasses.

Scalded and skinned carcasses differ significantly from singed carcasses in crude protein content. The range of 22.25 – 28.20 observed in this study, with scalding having the highest value of 28.20% followed by 28.13% in skinned carcasses and 22.25% in singed carcasses. The least value for singed carcass is attributed to the heat applied, heat is known to denature protein composition in meat. The range of 26.86 - 29.14 obtained for DM is within the range earlier reported by Fasae et al. (2011)[4] for the same breed of sheep but is not in line with the range proportions for DM obtained by Omojola and Adesehinwa, (2006)[3] for rabbits using the same methods. In their work, scalded rabbits have the least DM and highest in singed rabbit carcasses. The reason for which might be due to the difference in species and body size. The non-significance in the various values obtained can be attributed to the management system which the sheep are raised- (extensive system), characterized by long trek in search of food that exposes the animals to diseases and harsh weather which would have resulted into a lean carcass. Lambs on the higher feeding level deposited more fat around the internal organs and in the tail [22], which is in contrary to the basis of this research work. There is a need to reduce the fat content of the carcasses of meat-producing animals, as consumers in many countries are demanding less fat in their meat, mainly for reasons of the perceived benefits to health [23]. Production of excess fat in carcass is also inefficient in terms of energy resources required [24].

The sensory evaluation of WAD sheep's meat was greatly affected by the dressing method employed. The panellists scored meat from scalded carcasses higher (P<0.05) than meat from singed and skinned carcasses in colour. The result corroborates the findings of Omojola and Adesehinwa, (2006)[3] and Omole et al. (2005) [25]. It is however at variance with the result of Omojola et al. (2012)[26] in which singed buck carcass was rated highest for colour. The implication of this is that meat from skinned ram may be less acceptable since meat colour is the first criterion that consumers use to judge meat quality and acceptability [27]. The flavour rating of the meat from singed carcasses was highest (P<0.05) but there was no significant difference between the rating of scalded and skinned carcasses. Omole et al. (2005)[25] reported flavour rating of 7.59 and 7.25 for singed and scalded grass-cutter carcasses respectively. Omojola et al. (2012)[26] also reported highest rating for flavour in singed goat carcass over skinning and scalding. The highest rating of singed carcasses for flavour can be attributed to the smoky flavour impacted on the meat by singeing process [5]. Better flavour of singed carcasses could also be attributed to increased fat solubilisation at higher temperature [28]. Increase in flavour could also be due to greater activity of mallard reaction and associated reactions involving muscle protein, carbohydrates, such as free glucose and lipid and their degradation products [29]. The differences in the flavour could also be attributed to Hypoxanthine, which is a product of breakdown of ATP, also, other products of decomposition of fat and protein contribute to meat flavour [28].

The dressing methods did not affect (P>0.05) meat tenderness across the treatments. The observed decrease in meat tenderness, which is accompanied with the low rate of post mortem pH decline [35], might be caused by the activity of endogenous enzyme system in the muscles and myo-fibre characteristics which varied with gender, breed, rearing type and age at slaughter [30]. Highest tenderness (least toughness) obtained for skinned carcasses could be as a result of absence of heat during dressing, the lowest tenderness (highest toughness) obtained for singed carcasses was attributed to the intense heat applied during dressing, this could have caused shortening of the myofibres (myofibril shortening) [31]. There was a significant (P<0.05) difference observed in the juiciness score for skinned and singed carcasses. Highest (P<0.05) score was observed in skinned carcasses (7.31) which ranked the same with scalded meat with the lowest score reported for singed carcasses (6.80). This can be attributed to the lower cooking loss recorded in scalded and skinned carcasses, the lower the cooking loss, the better the juiciness of the meat [26]. The least value recorded in singed carcasses could be attributed to the higher cooking loss as a result of heat applied during dressing. The heat applied would have caused shrinkage in the meat with loss of juice from the meat, hence less juiciness unlike skinned carcasses with little or no loss of juice because no heat was applied during dressing. Cooking loss was found to be highest in singed carcasses which could be attributed to the heat applied during dressing which have initially caused reduction in the fluid (juice) contained in the meat. The muscle structure had earlier been punctured by the heat applied during singeing which had led to drain of juices. The least value was however recorded for scalded carcasses. The result of cooking loss obtained in this study partially corroborate the findings of Omojola et al.(2012)[26] who reported singed buck carcass to have the highest cooking loss and skinned buck carcass to have the least value. It was however at variance with the findings of Awosanya and Okubanjo, (1993)[32] who reported no significant (P>0.05) difference in the cooking losses of meat from leg, loin and shoulder cuts of skinned, scalded and singed rabbit carcasses. Overall acceptability of skinned and singed carcasses ranked equal (P>0.05). Colour is the most important optical attribute to food appearance and appearance may be the most important sensory attribute of food choice. Meat acceptability is mostly based on attractive colour, desirable flavour in the first instance and the combined effects of juiciness, tenderness and texture of a meat as evaluated by individual consumer [26]. The acceptability of scalded carcasses could be attributed to its attractive colour and juiciness which most consumers cherish in meat, especially in the developing countries.

There was no significant (P>0.05) difference in the pH of the scalded, skinned and singed carcasses at 24 hours post-mortem. However, singed meat has the highest pH of 6.78 while 6.45 and 6.22 were recorded for scalded and skinned meat respectively. This result is in agreement with the findings of Monin et al. (1995)[21] who reported that there was no significant difference in the pH of scalded or singed pigs' carcasses taken at *Longissimus lumborum*at 20 hours post-slaughter. Also, Omojola et al. (2012)[26] reported pH values of 5.70, 5.62 and 5.54 for singed, scalded and skinned carcasses of Red Sokoto buck taken at *Longissimus dorsi* muscle at 0 hour post-mortem. The result is also in agreement with Omojola and Adesehinwa (2006)[3] who reported no significant (P>0.05) difference in the pH of scalded, skinned and singed carcasses of rabbit with the highest pH recorded for singed carcass (6.31) and least for skinned carcass (5.99). The increase in pH values of the singed and scalded ram carcasses at 24 hours post-mortem could be due to modification of electric charges of acid groups, separation of peptide chain and subsequent production of new components [33], or could be attributed to the fission of protein chain at labile linkages involving inidazole,-SH and OH groups, followed by hydrogen bonding between carboxyl and amino groups [34]. The implication of this high pH (as in singed carcass) is that the meat will be unsuitable for storage because it will aid favourable development of proteolytic micro-organisms.

Conclusions

As a whole, scalding and singeing can be used to achieve a greater DP which confers more profit to the butcher in terms of higher weight of cuts but scalding can be employed to a much greater extent as it is economical in time but the time can increase as the degree of hairiness of the carcass. Singed carcasses are generally acceptable, showing greater preference in terms of flavor and colour. However, any of the processing methods in view can be used if the interest is on the nutritional benefit.

Conflict of interest

The authors declare no competing financial interest

References

1. Apata, E.S. Quality attributes of Red Sokoto buck meat as influenced by Post-slaughter processing methods. *Ph.d Thesis*, Department of Animal Science. University of Ibadan, Nigeria (2011).
2. Lathan, M.C.. Human Nutrition in the Developing world, FAO. Rome. Italy. 508p.
3. Omojola, A.B. and Adesehinwa, Meat Characteristics of Scalded, Singed and Conventionally Dressed Rabbit Carcasses. *W. J. Zoology*, **1**, 24-29. (1997).
4. Fasae, O.A., Adu, I.F., Aina, A.B.J. and Dipeolu, M.A., Growth performance, carcass characteristics and meat sensory evaluation of West African dwarf sheep fed varying levels of maize and cassava hay. *Trop Anim. Health Prod* **43,** 503-510 (2011)
5. Okubanjo, A.,. Meat characteristics of singed and conventionally dressed chevon Carcasses. *J. Food Sci.*, **34**, 494-197 (1997).
6. Adu, I.F. and Brinckman, W.L., Feedlot performance and carcass characteristics of sheep fed varying concentrate levels. *Journal of Animal Production Research,* **1,** 1-12(1981).
7. AOAC., Official Methods of Analysis. 15th ed. Arlington, Virginia. *Association of Official Analytical Chemists*. (1990).
8. AMSA, Research Guidelines for Cookery, Sensory Evaluation and Instrumental Measurements of fresh meat. National Livestock and Meat Board, Chicago, IL, USA. (1995).
9. AMSA, Guidelines for cookery and sensory evaluation of meat. American Meat Science Association, Chicago, 33. (1978).
10. SAS, SAS User's Guide. Statistical Analysis System, SAS Institute Inc., Cary. (1999).
11. Duncan, D.B., Multiple range and Multiple *F* test. *Biometrics* (**1**), 1-42 (1955).
12. Makinde, T.E., Comparison of the carcass characteristics of West African dwarf sheep and Yankasa sheep managed semi-intensively: Unpublished Undergraduate project Department of Animal production and Health, University of Agriculture, Abeokuta. (2002).

13. Cassey, B.H and Van Neikerk, W.A. The Boer goat. Growth, nutrient requirement, carcass and meat quality. Boer goat's reports, Department of Livestock Science, Faculty of Agriculture. *University of Pretoria, South Africa*. pp. 4-5(1988).

14. Devendra. C. and Owen, J.E. Quantitative and qualitative aspects of meat production from goats. *World Animal Review*, **48** (3), 19-37(1983).

15. Mahgoub, O., Lu., C.D. and Early, R.J., Effects of dietary energy density on feed intake, body weight gain and carcass chemical composition of Omani growing lambs. *Small Ruminant Research*. **37**, 35-42 (2000).

16. Kawas, J.R., Garcia, C.R., Garza, C.F., Fimbres, D., Olivares, S.E., Hernandez, V.G. and Lu,C.D., Effects of sodium bicarbonate and yeast on the productive performance and carcass characteristics of light weight lambs fed finishing diets. *Small Ruminant Research*, **67**, 157-163 (2007).

17. Alkoiret, T., Manne, A.A.S., Gbangboche, A.B. and Attakpa, E.Y.,. Fattening performance of Djallonke sheep supplemented with cotton seed husks in Benin. *Livestock Research for Rural Development* **19** (8), (2007) http://www.lrrd.org/lrrd19/10/alko19141.htm

18. Adu, I.F. Carcass yield and composition of Indigenous and Suffolk's crossbred sheep. *African Journal of Agricultural Sciences,* **9**(1+2), 63-72(1982).

19. Fasae, O.A., Adu, I.F., Aina, A.B.J. and Dipeolu M.A. Carcass yield and composition of West African dwarf rams. *Trop. J. Anim. Science*. **1-2**, 225-229. (2007).

20. Pe˜na, F., Cano, T., Domenech, V., AlcaldeMa. J., Martos, J., Garc´ıa-Martinez,, A., Herrer, H., and Rodero, E., Influence of sex, slaughter weight and carcass weight on "non-carcass" and carcass quality in segure˜na lambs. *Small Ruminant Research*: **60**, 2005,247–254. (2005).

21. Monin, G., Talmant, A., Aillery, P. and Collas, G. Effects of carcass weight and meat quality of pigs dehaired by scalding or singeing post mortem. *Meat Sci*., **39**, 247-254(1995).

22. Fozooni, R. and Zamiri, M.J. Relationships between chemical composition of meat from carcass cuts and the whole carcass in Iranian fat tailed sheep as affected by breed and feeding level. *Iranian Journal of Veterinary Research*, **4** (21), 30 4 (2007).

23. Allen, P. New approaches to measuring body composition in live meat animals. In: Wood, JD and Fisher, AV (Ed.), Reducing fat in meat animals. London, UK, Elsevier. pp:201-254. (1990)

24. Cameron, N.D. and Bracken, J. Selection for carcass lean content in a terminal sire breed of sheep. Anim. Prod., **54**, 367-377 (1992).

25. Omole, A.J., Ayodeji, I.O., Ashaye, O.A. and Tiamiyu, A.K., Effect of Scalding and Flaming Methods of Processing on Physico-chemical and Organoleptic Properties of Grass-cutter Meat. *Journal of Applied Sciences Research,* **1**(2), 249-252 (2005).

26. Omojola A. B., Apata E. S. and Fagbuaro S. S., Comparison of Skinning versus Scalding and Singeing: Effect on Temperature, pH and Meat Quality in Goats. *J. Anim. Sci. Adv.,* **2** (9), 740-748 (2012).

27. Conforth, D. P. Color- its basis and importance. Quality Attributes and their measurement in: Meat, Poultry, and Fish Products: Advances in Meat Research. A. M. Pearson, and T. R. Dutson eds. Springer, London. 34-75(1995).

28. Lawrie, R.A. and Ledward, D.A., *Lawrie's Meat Science,* 7th ed., Cambridge: Woodhead Publishing Limited (2006).

29. Simmon, S.I., Car, T.R., and Mckitech, J.K., Effect of internal temperature and Thickness on palatability of pork loin chops. *Journal of food science,* **50**, 313-315 (1985).

30. Bünger, L., Navajas, E.A., Stevenson, L., Lambe, N.R., Maltin, C.A., Simm, G., Fisher, A.V. and Chang, K.C. Muscle fiber characteristics of two contrasting sheep breeds: Scottish Blackface and Texel. *Meat Sci*, **81**, 372-81(2009).

31. Locker, R.H. and Hagyard, C.J., A cold shortening effect in beef muscles. *Journal of the Science of Food and Agriculture,* **14***,* 787-794 (1963).

32. Awosanya, B. and Okubanjo, A.O., Effect of skinning, scalding or singeing on the physical characteristics of rabbit carcasses. *Nig. Food Jour.,* **11***,* 147-152(1993).

33. Carnegie P.R. Separation of low molecular weight peptides from amino-acids on 'DEAE-Sephadex'. *Nature,* **78**, 692-696 (1961).

34. John L.W. pH-controlled hydrogen-bonding. *Biochem. J.,* **143**(3), 775-777 (1971).

35. Lambe N.R., Navajas E.A., Fisher A.V., Simm G., Roehe R., Bünger L. Prediction of lamb meat eating quality in two divergent breeds using various live animal and carcass measurements. *Meat Sci*., **83**, 366-75 (2009).