Effects of Breeds and Spices on Water Holding Capacity and Consumers Acceptability of Goat Meat (*Chevon*)

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Target Audience: Meat and Meat Products Processors and Consumers

Abstract

Five muscles, semitendinosus (ST), Biceps femoris (BF), Longissimusdorsi, (LD), Triceps brachii (TB) and Brachialis (BC) were excised from twelve Goats buck carcasses of two breeds, the West African Dwarf and Red Sokoto, 50g of each muscle was cooked with four different spices; ginger (A) garlic (B), alligator pepper (C) and black pepper (D) to determine their effects on water holding capacity and acceptability of the muscles. The muscles together with the spices were cooked for 20 minutes and cooled to room temperature (about 25°C), 1g of each muscle was removed and pressed to determine the water holding capacity, while the rest of the muscles were served to 10 member taste panel to assess the muscles for acceptability based on their flavour on a 9 point hedonic scale. The results (49.80, 48.30) showed that muscles cooked with ginger (A) had higher water holding capacity while those cooked with garlic (B) had the least (28.50, 25.30). Muscles from WAD buck goat (BF 49.80) had higher water holding capacity. Muscles cooked with garlic (B) (8.67, 7.80) were highly preferred by the taste panelists while muscles cooked with alligator pepper (C) (4.32, 4.15) were least accepted. It was evident from the results of this study that spices can improve water holding capacity and acceptability of chevon. Ginger (A), favoured high water holding capacity while garlic (B) is recommended for high flavour and acceptability of chevon.

Keywords: Spices, goat, Water holding capacity, Acceptability, Chevon.

Description of Problem

Goat meat (chevon) is a rich source of food that is consumed worldwide especially in developing countries. The popularity of chevon in these areas is long established and may be related to low cost of production and numerous other by-products that goats yield apart from meat (1). The West African Dwarf (WAD) and Red Sokoto

goats are the most common species of goat in West African sub-region and together accounted for about 59% of goat population in Nigeria. (2). Goat breeds often influence carcass composition and muscle characteristics, with resulting differences in carcass and meat value (3). Differences in goat meat acceptability due to breed was reported (4). In another studies, differences in overall acceptability among male goats of different breeds as well as in their muscle (5) were reported.

The "goaty" odour of meat from goat attributed to the presence of 4-methyloctanoic (hircine) acid as well as its less tender and juicy nature with more residue, shear resistance and collagen content makes it less acceptable to most meat consumers in developed countries (6). Spices have been used to improve organoleptic characteristics of food meat inclusive (7) without given proper attention to their effects on water holding capacity of meat.

Water holding capacity which is the ability of meat to retain its water during application of external force is obviously the most important quality of meat since many physical properties of both raw and cooked meat such as texture, juiciness; flavour and overall acceptability partially dependent upon it (8). It had been reported (9) that blending spices with meat enhances its water holding capacity and discourages cooking losses, thereby improving the qualities of meat most especially, juiciness, tenderness, flavour and overall acceptability. (10)Observed differences in eating qualities of chevon resulting from breeds and muscles

differences within a carcass.

Also, (9*)*reported that biceps femoris (BF) muscle was best preferred in beef. Thus, the objective of this study is to make a comparative evaluation of water holding capacity and acceptability of goat meat (chevon) from two breeds and their muscles cooked with inclusion of different spices namely; ginger, garlic, alligator pepper and black pepper.

Materials and Methods
Experimental animals
Twelve matured buck goats of two breeds, West African Dwarf (WAD)(6) and Red Sokoto(6) within the weight range of 10.50 to 11.52kg and 10 to 12 months old were purchased and used for this study.

Slaughtering and processing of carcasses
Animals were rested, slaughtered in pairs without prior immobilization after fasting them for 16 hours, but with access to clean and cold water. Their shrunk weights were taken (11). The carcasses were dressed with conventional (Skinning) method (12). The carcasses were chilled at $4^{\circ C}$ for 24 hours and were fabricated into wholesale cuts.

Muscles dissection
Five muscles used in this study were dissected from three wholesale cuts; leg, Loin and shoulder. Two muscles were dissected from leg and shoulder cuts while one muscle was dissected from the Loin namely; Semitendinosus (ST) and Biceps femoris (BF) from the leg, Triceps branchii (TB) and Brachialis from the shoulder and Longissimus dorsi (LD) from the Loin. The muscles

were weighed individually, wrapped in polythene bags and stored (in a refrigerator) for further processing (cooking).

Spices used in this Study

Four different spices were used in this study viz: Ginger (A) (*Zingiber officinale*) Garlic (*Alliurn-sativum*), (B) Alligator Pepper (*Afromomum melegueta)* (C) and Black pepper (*Piper Gunineens*) (D). They were purchased and ground into powder with an electric grinder (13) and packaged in polythene bags with labelings.

Proximate composition of spices

The proximate composition of spices tested in this study was carried out following the procedures of (14). Moisture content was obtained by drying the spice samples (2g) in an oven at (100-1*05°C)*until a constant weight was obtained. Crude protein of spice samples was determined using Kjeldahl methods which comprised digestion,

distillation and titration of the distillate, Crude protein values were derived by converting nitrogen (N%) content obtained through titration with a constant (6.25) thus crude protein was obtained as (6.25 x %). Ether Extract was determined with soxhlet extraction method using petroleum ether. The spices were dried in an oven for 4 hours and fat was extracted. Ash content in the spices was determined by igniting them in a Muffle Furnace at (550-600°C) for 24 hours until ashes were formed.

Cooking of muscles

Boiling method was employed in this study for cooking the muscles. Each muscle was removed

From there refrigerator, equilibrated to room temperature (23-25^0C) and weighed (50g) into a beaker (1000ml) and spices (10g) added following the procedures of (13) and were boiled to an internal temperature of *72°C.* The following cooking arrangements were used:

T_1 - Each muscle (50g) from the two breeds of goat was cooked with Ginger (A) added
T_2 - Each muscle *(50g)*from the two breeds of goat was cooked with Garlic (B) added
T_3 - Each muscle (50g) from the two breeds was cooked with Alligator pepper (C) added
T_4 - Each muscle (150g) from the two breeds was cooked with Black pepper (D) added.
Each treatment was replicated thrice.

Measurement of water holding capacity of muscle (meat)

This was determined using the press method according to (15). Approximately 2g portion was removed from each muscle sample after boiling and was placed in between two 9cm

whatman No 1 filter paper and pressed between two 10.2 x 10.2cm plexiglasses with a vice, for 1 minute. The area of free water was measured using grid method based on the muscle samples weight and moisture content as follows:

$$\text{WHC} = \frac{100 - (\text{Aw} - \text{Am}) \times 9.47}{\text{WHC} =} ⬚100$$

Where:

Aw = Area of water released from the muscle samples (cm^2)

Am = Area of muscle samples $(cm^{2'})$

Wm = Weight of muscle (meat) samples (g)

MC = Moisture content of muscle samples (%)

9.47 = Constant factor.

Measurement of acceptability of muscle (meat)

A semi-trained 10-member taste panel was used to assess each muscle cooked with an individual additive for acceptability based on flavour ratings of the muscles on a 9-point Hedonic scale where 1 was equivalent to extremely undesirable, 2 very undesirable, 3 moderately undesirable, 4 slightly undesirable, 5 intermediate, 6 slightly desirable, 7 moderately desirable, 8 very desirable and 9 extremely desirable (16).

Experimental design and statistical analysis

Completely randomized Design (CRD) was employed for this study. Data generated from this study were analyzed statistically with (17) for variance, while the means were separated with Duncan multiple range test of the same software.

Results and Discussion

The chemical composition of spices used in this study is shown in (Table 1) Garlic (B) had the higher(P<0.05) dry matter (92.12%) and ether extract (fat) 9.21% while black pepper (D) had the higher(P<0.05) Crude protein (13.12%) Alligator pepper (C) had the higher(P<0.05) Ash content (7.50%) while Ginger (A) had higher(P<0.05) Nitrogen free extract (74.28%).Table 2 shows the results of mean effects of breeds and different spices on water holding capacity of muscles from West African Dwarf and Red-Sokoto bucks. There was significant (P<0.05) differences in the mean water holding capacity (WHC) between breeds and spices as well as between muscles and the spices. Water holding capacity was higher (47.30) in WAD buck goat semitendinosus (ST) muscle cooked with all the spices except with garlic (B). It was also higher (P<0.05) in biceps femoris (BF)*(49.80)*muscle cooked with ginger (A) in both breeds, although with the same statistical value; but it was higher(P<0.05) in WAD buck goat biceps femoris(BF) muscle cooked with alligator pepper (C) and black pepper (D) than in Red Sokoto biceps femoris (BF) muscle cooked with garlic (B) in both breeds. Longissimus dorsi (LD) muscle cooked with ginger (A) had the higher(P<0.05) (48.45) water holding capacity in both breeds, as well as in the same muscle cooked with alligator pepper (C) in WAD buck goat followed by the WHC of the same muscle cooked with Alligator pepper (C) in Red-Sokoto breed and least (P<0.05) in the same muscle of Red- Sokoto buck goat cooked with garlic (B). Water holding capacity of triceps brachii(TB) muscle was higher(P<0.05) (46.50) when cooked with ginger (A) in both breeds of buck goat, but it was higher(P<0.05) (37.85) in the same muscle cooked with alligator pepper (C), black pepper (D) and garlic (B) in WAD buck goat compared with the same muscles in Red Sokoto buck goat cooked with the same spices. Also WHC was higher (P<0.05) in brachialis (BC) (46.05) muscle of WAD buck goat cooked with all spices, than in Red-Sokoto buck goat.

Table 1: Proximate analysis(%DM) of spices

Variable	Additives				
	A	**B**	**C**	**D**	**SEM**
Dry Matter	91.20[b]	92.12[a]	90.00[c]	89.10[d]	2.47
Crude Protein	8.42[d]	10.15[c]	11.40[b]	13.12[a]	1.20
Ether Extract(fat)	3.80[d]	9.21[a]	7.13[c]	8.20[b]	0.31
Ash Content	4.70[b]	2.70[c]	7.50[a]	4.60[b]	0.34
NFE	74.28[a]	70.06[b]	63.97[c]	63.18[c]	1.82

abcd: Means with different superscripts in the same row are statistically significant (p<0.05).
A= Ginger; B= Garlic; C= Alligator pepper; D= Black pepper.

The overall results of water holding capacity revealed that it was higher(P<0.05) in all the muscles cooked with ginger (A), followed by muscles cooked with garlic (B) in both breeds of buck goat. The results also indicated that WHC was higher (P<0.05) in all the muscles of WAD buck goat than in Red-Sokoto buck goat. Furthermore, the longissimusdorsi (LD) muscle had the higher(P<0.05) water holding capacity, followed by biceps femoris (BF), semitendinosus (ST), triceps brachii(TB) and brachilais (BC) muscles cooked with each of the spices in both breeds of buck goat. Water holding capacity of muscles cooked with different spices could be attributed to the amount of fat (EE) contained in each of the spices used. The water holding capacity of the muscles took this trend in both breeds of buck goat. It was reported (18) that when fat is in contact with water, there is a high interfacial tension between the two phases. Since fat contents of those spices (garlic B); black pepper (D), and alligator pepper (C) were high, that could cause tension between fat and water phases of the spices and muscles thereby reducing the water holding capacity of the muscles they were cooked with. The mean scores for chevon acceptability is presented in Table 2. There were significant (P<0.05) differences in acceptability of muscles of two breeds of buck goats cooked with different spices.

Table 2: Water holding capacity of chevon muscles' as affected by breeds of goat and spices

	Treatments								
	A		B		C		D		
Variable	WAD	RS	WAD	RS	WAD	RS	WAD	RS	SEM
ST	47.30[aw]	45.20[bw]	30.85[gw]	30.75[gw]	39.75[cW]	38.50[dw]	35.50[ew]	32.80[fw]	0.70
BF	49.80[ax]	48.30[bx]	39.50[gx]	38.95[gx]	48.70[cX]	47.50[dx]	46.25[e]	44.15[fx]	0.65
LD	48.45[ay]	47.22[by]	33.30[fy]	32.95[gy]	46.50[by]	42.50[cy]	40.45[dy]	35.30[cy]	0.68
TB	46.50[az]	45.20[bw]	29.75[fv]	28.50[gv]	37.85[cZ]	36.75[dz]	36.40[dv]	30.85[ev]	0.72
BC	46.05[az]	42.0.5[bz]	28.50[fz]	25.30[gz]	38.10[cZ]	35.90[dz]	33.70[cZ]	28.60[fz]	0.76

abcdefg: Means in the same row with different superscripts are statistically significant [P<0.05]. wxyz: Means along the same column with different superscripts are statistically significant [P<0.05] WAD = West African Dwarf buck goat, RS - Red Sokoto buck goat, A = Ginger: B = Garlic, C = Alligator pepper, D = Black pepper, ST = Semitendinosus muscle, BF = Biceps femoris muscle, LD = Logissimusdorsi muscle TB = Triceps brachii muscle, BC = Brachialis muscle

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