

# EFFECT OF FROZEN STORAGE ON THE ORGANOLEPTIC PROPERTIES OF MEAT FROM WEST AFRICAN DWARF BUCK

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## ABSTRACT

**M**eat samples from West African dwarf buck were stored at  $-10^{\circ}\text{C}$  for 6 weeks with the aim of studying the effect of frozen storage duration on organoleptic properties. Analysis of variance showed that the flavor of the meat was significantly better ( $P < 0.05$ ) at the commencement of storage than 2 weeks later. Mean flavor rating at 4 weeks was higher ( $P < 0.05$ ) than that at 6 weeks but no higher than rating at 2 weeks ( $P > 0.05$ ). Changes in color and juiciness were not-significant ( $P > 0.01$ ) throughout storage period while those in texture and overall acceptability were non-significant ( $P > 0.05$ ). There were high, but negative and very highly significant correlations ( $r = -0.83$  to  $-0.99$ ;  $P < 0.001$ ) between duration of storage and organoleptic properties, as well as overall acceptability of the meat, with storage duration accounting for 90% and 99% of the variabilities in flavor and acceptability respectively. Strong positive and very highly significant correlations ( $r = 0.87$  to  $0.97$ ;  $P < 0.001$ ) were observed between acceptability and the juiciness, texture and flavor ratings. The strong influence of flavor on acceptability supported the widespread but unpublished indications and reports of the desirability of the strong sex odour by buck meat consumers in southeastern Nigeria.

**Key words:** Buck meat, WAD goat, Frozen Storage, Organoleptics.

## INTRODUCTION

Goat meat constitutes a large fraction (over 30%) of the total volume of red meat consumed in Nigeria (Adu *et al.*, 1990) and is more acceptable than mutton and beef in many countries and regions like Ghana, India, Southeast Asia and the Carribeans (Jollans, 1959; Bose, 1963), due probably, to its

high lean content and the absence of taboos in its usage. The mature buck of the West African Dwarf goat has a strong peculiar sex odor, which gives meat obtained from the animal an intensive flavor. The attitude of consumers to such strong flavors in meat varies with culture and the product in question. The boar odor for instance, is generally objectionable (Pearson *et al.*, 1977). In Nigeria, the Dwarf buck meat flavor is highly desirable by consumers, especially in the southeastern States (Ekanem, personal communication). Consumers strongly prefer buck meat from this native breed to meat obtained from either the female of this breed, or from the male (and female) of other local goat breeds like the Kano Brown or Yankasa, Borno Red and Red Sokoto (Maradi).

Some quantity of goat meat is usually preserved in commercial operations in Nigeria under frozen conditions, although the changes in sensory qualities of the product during frozen storage have not been studied. Such changes occur due to autolytic activities, which alter meat texture and produce unpleasant flavors which may reach objectionable levels (Gills, 1988). This study was undertaken to assess organoleptic changes in frozen stored West African dwarf buck meat, with particular reference to flavor, an important factor affecting the acceptance of the product.

## MATERIALS AND METHODS

Meat samples from the thigh of buck and carcasses were obtained from the Etaha Itam meat market, near Uyo, the Akwa Ibom State Capital, Nigeria. Upon purchase, the fresh meat was quickly transported to the laboratory (about 3 km) from the market. At the laboratory, the meat was divided into four portions (0.5 kg each). One portion was cut into steaks ( $2.50 \pm 0.25$  cm thick), heated to

boiling with three parts (w/v) of water and cooked for a further 25 minutes. The cooked meat was presented for sensory evaluation by a panel of 10 trained judges, according to the conditions and methods described by Amerine *et al.* (1965). The remaining three portions were packed separately in low density polyethylene bags, quick-frozen and stored at  $-10^{\circ}\text{C}$ , the average operational temperature of most commercial freezing facilities in Uyo. A random sample of the frozen meat was taken fortnightly (over a period of 6 weeks) for sensory assessment in the same form and manner earlier described above.

Data generated were subjected to analysis of variance according to the method outlined by Harnett (1982). Inter-relationships among some of the quality attributes of the meat were studied by correlation analysis using the linear model. Proximate analysis was carried out as described by AOAC (1975).

## RESULTS AND DISCUSSION

Results in Table 1 show taste panels evaluation of organoleptic qualities of the buck meat. Analysis of variance showed that the flavor rating of the product was significantly higher ( $P < 0.05$ ) at the beginning of storage than it was at 2 weeks. Mean flavor score at 2 weeks storage was however, not different ( $P > 0.05$ ) from the score at 4 weeks, which was better ( $P < 0.05$ ) than that at 6 weeks. Changes in mean scores of colour and juiciness were not-significant ( $P > 0.1$ ) throughout the duration of storage, while those for texture and overall acceptability were non-significant ( $P > 0.05$ ). The non-significance of the effect of storage duration on most organoleptic properties of the meat indicated that cold storage at  $-10^{\circ}\text{C}$  was effective in maintaining these sensory qualities well within acceptable limits up to the 6 weeks covered in

TABLE 1: SENSORY ASSESSMENT OF COOKED BUCK MEAT STORED AT  $-10^{\circ}\text{C}$

Duration of storage (Week)s	Flavor	Colour**	Sensory scores <sup>+</sup> Texture*	Juiciness**	Overall* acceptability
0	7.9 ± 0.50 <sup>a</sup>	7.9 ± 0.93	8.1 ± 0.63	7.9 ± 0.84	8.0 ± 0.66
2	7.4 ± 0.57 <sup>b</sup>	7.4 ± 0.90	7.6 ± 0.68	7.3 ± 0.82	7.7 ± 1.00
4	7.4 ± 0.58 <sup>b</sup>	7.4 ± 0.87	7.6 ± 0.69	7.6 ± 0.79	7.5 ± 0.80
6	6.8 ± 0.60 <sup>c</sup>	7.0 ± 0.92	7.2 ± 0.72	6.6 ± 0.69	7.2 ± 0.80

+ Mean score + S. D.

a,b,c, Means within columns with different supercripts are significantly differen ( $P < 0.05$ )

\*\* Highly non-significant ( $P > 0.1$ )

\* Non-significant ( $P > 0.05$ ).

TABLE 2: CORRELATION COEFFICIENTS BETWEEN SCORES FOR SENSORY PROPERTIES AND ACCEPTABILITY, AND BETWEEN STORAGE DURATION AND SCORES FOR SENSORY PROPERTIES OF BUCK MEAT.

Independent Variable (X)	Dependent variable (Y)	Correlation Coefficient (r)
Flavor	Overall acceptability	0.97***
Juiciness	Overall acceptability	0.87***
Texture	Overall acceptability	0.97***
Storage duration	Flavor	-0.95***
Storage duration	Juiciness	-0.83**
Storage duration	Texture	-0.95***
Storage duration	Overall acceptability	-0.99***

\*\*\* Very highly significant ( $P < 0.001$ )

\*\* Highly significant ( $P < 0.01$ )

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this study. From the results, prolonged cold storage may however, not satisfactorily keep buck meat if consumers indeed, attach high importance to the flavor of the meat. The results of the present study agree (except with respect to flavor) with Jeremiah (1992) who found no significant differences ( $P > 0.05$ ) in sensory characteristics of chilled pork samples during 6 weeks of frozen storage, within which the highest flavor and texture amplitudes occurred. Okonkwo and Obanu (1986) had however, reported that goat meat loses its characteristic odor faster than beef. This supports the present results as regards flavor. Since part of the flavor loss problem may be due to ineffective packaging, specific studies appear to be necessary to identify the flavor substances in buck meat with a view to recommending packaging materials with suitable permeability properties for the meat.

This kind of investigation as well as others are recommended to elucidate the residence of the flavour substances. Pearson *et al.* (1977) had reported that in boars, the sex odor is concentrated in the lipid fraction of the meat.

Coefficients of correlation ( $r$ ) between scores for sensory properties and overall acceptability on the one hand, and between storage duration and scores for sensory properties and overall acceptability on the other hand, are presented in Table 2. The results revealed storing positive and very highly significant linear correlations ( $P < 0.001$ ) between acceptability and the ratings of the meat for juiciness, texture and flavor. Texture and flavor explained up to 94% of the variation in acceptability. Very high, but negative and very highly significant

correlations ( $P < 0.001$ ) occurred between storage duration and the flavor, juiciness and texture as well as overall acceptability of the meat. Storage duration accounted for 90%, 70%, 89% and 99% of the variabilities in these parameters, respectively. These results agree with Mishra and Srikar (1989) who obtained an  $r$  value of -0.99 for frozen storage duration and overall acceptance of clam meat. The strong influence of flavor on acceptability was expected. The result supported the widespread but undocumented reports of the desirability of the strong buck flavor by goat meat consumers. Results similar to those of the correlation analyses obtained in this study are available in their literature. According to Forest *et al.* (1975), the flavor of a product is responsible for many of the psychological and physiological responses (these determine acceptance) that result from meat consumption. The positive relationships between acceptability, texture and juiciness also agree with the general reports of Forest *et al.* (1975), as well as the specific results obtained by Solomon *et al.* (1994). However, the results of the present study contradicted Igene and Ekanem (1985) who observed a negative relationship ( $r = -0.50$ ) between taste panel acceptability and moisture content (an index of juiciness) of *suya*, a popular roasted ready-to-eat Nigerian meat snack. This difference could be due to the special nature of *suya*, which seems to be preferred in the dry state and to differences in the fat contents of the products, which may also influence organoleptic juiciness (Okeowo and Okubanjo, 1988). Proximate analysis (Table 3) showed that the fat content of the meat in the present study was high by standards reported in the

TABLE 3: EFFECT OF DURATION OF FROZEN STORAGE (-10°C) ON CHEMICAL COMPOSITION\* OF BUCK MEAT\*

Duration of storage (weeks)	Constituents (% wet weight)			
	Moisture	Protein	Ash	Lipid
0	73.0	23.0	0.5	8.0
2	72.8	22.0	0.5	7.9
4	72.0	21.9	0.5	-
6	72.0	22.0	0.5	-

\*Results represent means of duplicate determinations.  
-, Not determined

literature (Price, 1971; Forrest *et al.*; 1975). Frozen storage was effective in maintaining the chemical composition of the meat, with only very slight drops in moisture, crude protein and lipid contents over the storage period.

In this study, a significant loss of flavor occurred in buck meat during storage at  $-10^{\circ}\text{C}$  over 6 weeks. Color, texture, juiciness and overall acceptability ratings also dropped, but not significantly. The study has offered some support for the widespread but unpublished indications that goat meat consumers in southeastern Nigeria strongly desire the intense flavor of the meat of the West African Dwarf buck. Goat meat handlers and processors could raise the volume and profitability of their trades by noting this desire of consumers and taking steps to maintain the flavor of their products. This can be achieved through proper protective packaging and avoiding keeping the meat in the same storage compartments with other foods with strong odor which the meat could absorb.

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