



SENSORY EVALUATION OF TRADITIONALLY PROCESSED BEEF PRODUCTS IN MUBI METROPOLIS ADAMAWA NIGERIA

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Received in July 2025

Accepted in August 2025

Abstract

The study was conducted at the Department of Animal Production, Adamawa State University, Mubi. The study examined the sensory qualities of four traditionally processed beef products widely consumed in Northern Nigeria: Roasted beef (Balangu), beef jerky (Kilishi), spiced skewered beef (Tsire), and flaked beef (Dambun Nama), in Mubi, Nigeria. Sensory attributes data of the four processed beef products were collected using 6-point hedonic scale questionnaires and analysed using Analysis of Variance (ANOVA). The results obtained indicated that there is significant ($P < 0.05$) difference for all the parameters measured except in colour. The mean values showed that Dambun Nama (5.47 ± 0.73) had the mean score, while Kilishi (4.30 ± 1.09) recorded highest and lowest values in Flavor. Balangu (4.83 ± 1.12) and Kilishi (4.87 ± 1.01) had higher scores than the other methods in tenderness. Also, Balangu was the juiciest (5.37 ± 0.67), while Dambun Nama (4.27 ± 1.20) appeared to be the least juicy beef product. And in Overall acceptability, Balangu had the highest acceptability (5.53 ± 0.51), while Tsire (3.97 ± 1.22) appeared to be the least accepted beef product. the study concluded that balangu is the most accepted beef product overall. The study concluded that, sensory quality of traditionally processed beef products varies significantly depending on the method of preparation.

Keywords: Sensory Evaluation, Kilishi, Tsire, Balangu, Dambun Nama, Traditional Meat.

INTRODUCTION

Globally, there is increase in population which poses a serious challenge to food security, especially in developing countries (Onwe *et al.*, 2024). United Nations (2022) reported that the world population has exceeded 8 billion, with Nigeria's population projected to surpass 230 million, making it the most populous country in Africa. The growth in population and a corresponding increase in income have increase the demand for high quality food sources especially animal-based protein which is needed for growth, development and total well-being of an individual (FAO, 2023). Meat as an animal-based protein which

provides the consumer with essential amino acids, mineral and vitamins as well as micronutrients which are needed by the body especially, in children, pregnant women and sick individuals (Adeyeye *et al.*, 2021).

Traditional meat products form an integral part of Nigerian diets, offering a blend of cultural heritage, flavor, and protein-rich nutrition. According to Adesokan *et al.* (2018), Kilishi, Tsire, Balangu, and Dambun Nama are some of the most popular beef product and delicacies consumed in the Northern part of Nigeria. Even with the documented popularity of these traditional processing methods (Bube, 2003),

their effects on meat quality, and consumer acceptability have not been comprehensively evaluated (Adesokan *et al.*, 2018). It is worth noting that sensory evaluation provides vital insights into how processing influences product appeal, which is critical for quality assurance and product development (Agamoh *et al.*, 2021). Furthermore, consumers' preferences are influenced by sensory attributes such as texture, flavour, and tenderness, yet research on how different processing methods affect these factors remains scarce (Lawrie and Ledward, 2015). Therefore, the present study was aimed at evaluating the organoleptic attributes of beef products processed traditionally in Mubi metropolis, Adamawa State.

MATERIALS AND METHODS

Study Location

The study was conducted at the Department of Animal Production, Adamawa State University, Mubi. The area lies within the northern Guinea savannah zone of Nigeria. It is geo-located between latitude 10°16'6.9" north of the equator and longitude 13°16'1.2" East Greenwich meridian with 560 meters above sea level. The dry season of the area commences in November and ends in March, while the wet season begins in April and ends in late October. The mean annual rainfall is about 1050 mm. The relative humidity is extremely low (20–30%) between January and March but reaches a peak of about 80% in August and September. The maximum temperature can reach 40°C particularly in April while the minimum temperature is about 12°C between December and January (Meteorological Enclosure, 2024).

Source of Experimental Materials

Fresh samples of Kilishi, Tsire, Balangu, and Dambun Nama were purchased from local vendors in Mubi, Adamawa State. The samples were stored in sterile conditions and transported to the sensory evaluation study location within the Department of Animal Production Adamawa State University Mubi within two hours of purchase.

Sensory Evaluation

Balangu, Dambun Nama Kilishi and, Tsire, processed beef products were used for the sensory evaluation. Twenty-five (25) semi-trained panellists, selected from staffs and students of Faculty of Agriculture, of both sex and age ranging between 25–50 years were used. Each panellist was selected according to his/her potential based on preliminary screening and those accustomed to eating processed beef products. Prior to the sensory evaluation, the panellists were screened with respect to their interest and ability to differentiate food sensory properties. All treatments were served in random order. The panellist evaluated the samples seated in individual booths. A six (6) point hedonic preference scale according to Lawless and Heymann (2010), was used to assess the palatability of the beef products to grade how much they liked or disliked each sample. The parameters/factors rated was colour/appearance, flavour, tenderness, juiciness, and acceptability. The beef products were served on a disposable plate alongside toot pick, biscuit and bottled water to wash down the previous taste before the next.

Statistical Analysis

The data collected were analysed using Analysis of Variance (ANOVA). Means were separated using Tukey's Honest Significant Difference (HSD) test at 5% significance level using SPSS version 25.

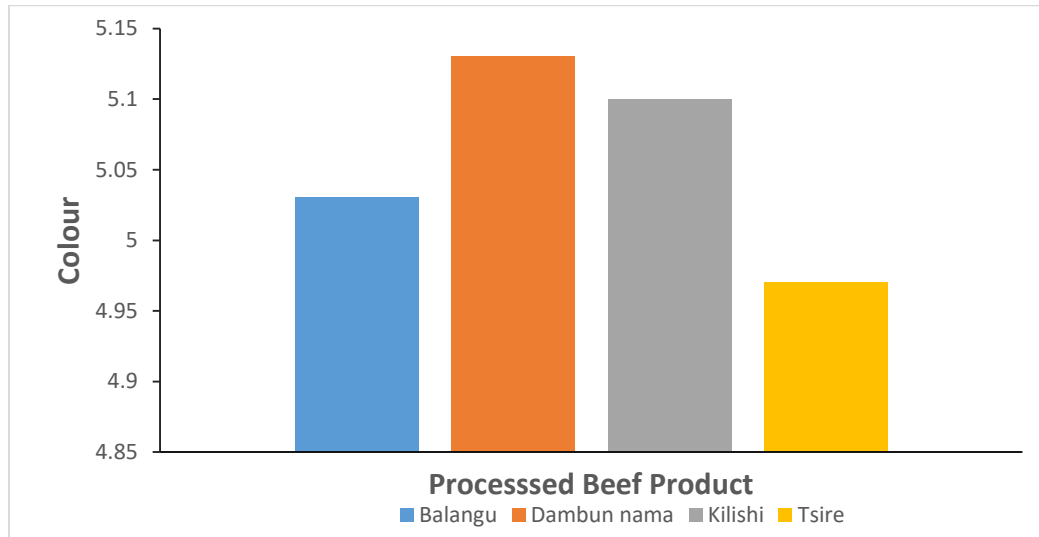


Figure 1: Colour preference of processed beef

RESULTS AND DISCUSSION

Colour

Although no significant ($P>0.05$) difference was observed in colour scores among Balangu, Dambun Nama, Kilishi, and Tsire, slight variations were noted, with Dambun Nama recording the highest mean score (5.13) and Tsire the lowest (4.97). This uniformity suggests that the traditional processing methods employed did not markedly alter the surface colour of

the beef products to a level easily detected by the panelists. According to Lawrie and Ledward (2015), meat colour is largely determined by myoglobin content and its chemical state, which may not be substantially influenced by moderate variations in heat or drying processes. Additionally, spices and surface browning from roasting or grilling could have masked subtle differences, as reported in studies on processed and spiced meats (Troy and Kerry, 2010).

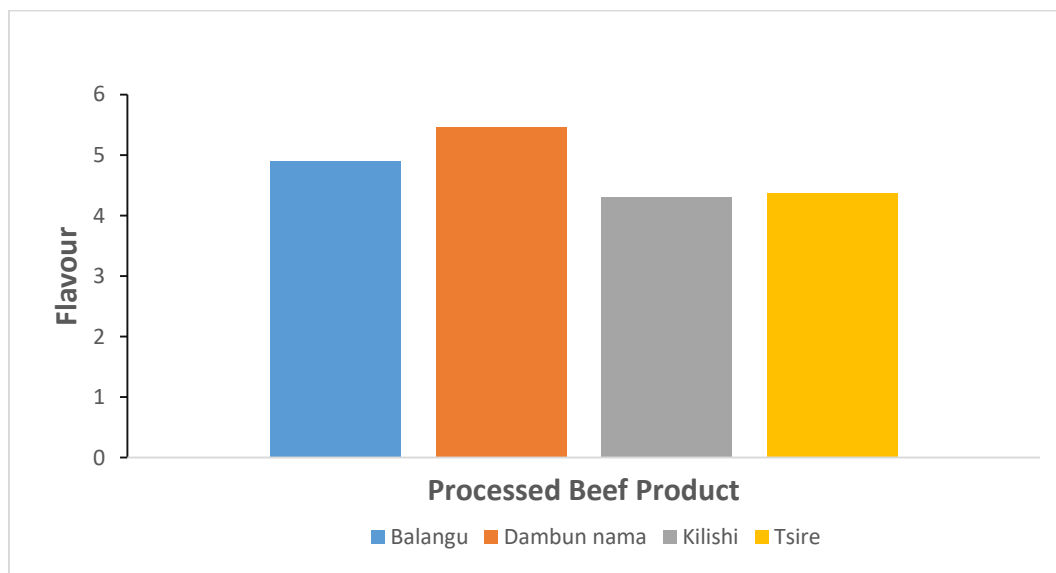


Figure 2: Flavour preference of processed beef products

Flavour

Significant ($P < 0.05$) differences were observed in flavour perception, with Dambun Nama rated highest (5.47) and Kilishi lowest (4.30). The superior flavour score of Dambun Nama is likely linked to its distinctive spice blend and milder heat application, which may help preserve volatile compounds and aromatic notes. Conversely, Kilishi's prolonged drying could cause

volatilisation of desirable flavour compounds, potentially resulting in a less favourable flavour profile for some consumers. This aligns with Kehlet *et al.* (2017), who emphasised the influence of seasoning and fat content on flavour development, and with Wood *et al.* (2008), who noted that intramuscular fat enhances flavour release during consumption.

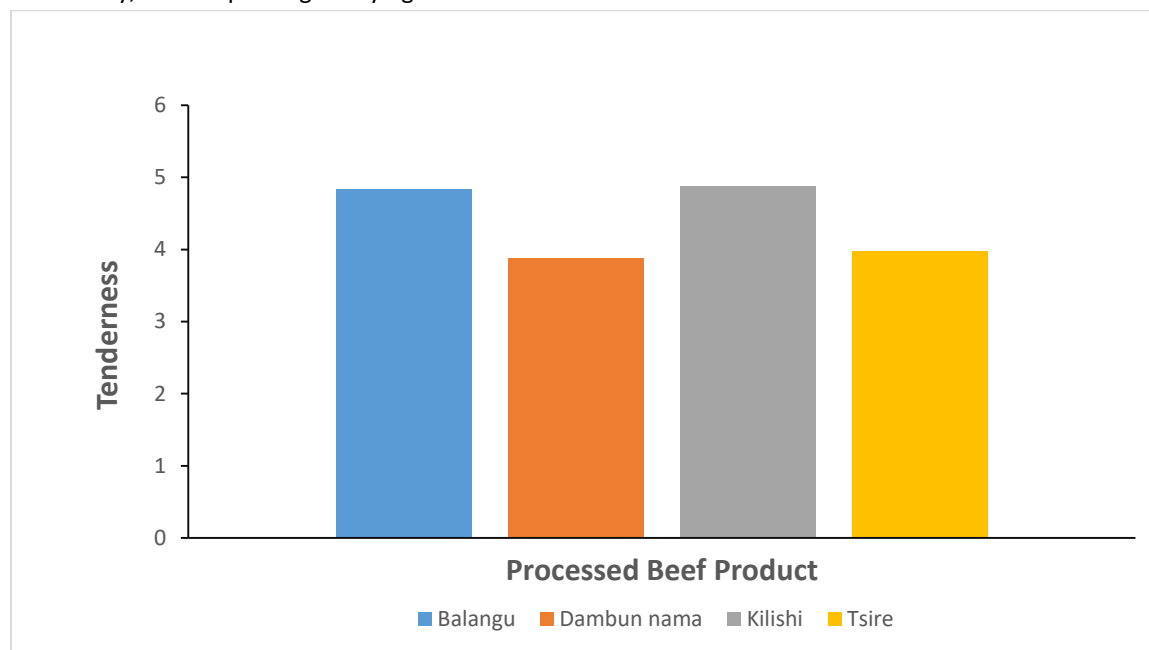


Figure 3: Tenderness preference of processed beef products

Tenderness

Tenderness scores differed significantly ($P < 0.05$), with Kilishi (4.87) and Balangu (4.83) outperforming Dambun Nama (3.87) and Tsire (3.97). The lower tenderness of Dambun Nama could be due to its extensive drying and flaking, which reduce water content and increase fibre toughness. Similarly, Tsire's exposure to high grilling temperatures likely resulted in protein denaturation and muscle fibre shrinkage, causing increased firmness (Tornberg, 2013). Balangu's relatively high tenderness is consistent with its slow-roasting method, which promotes gradual collagen breakdown while avoiding excessive moisture loss (Naveena *et al.*, 2011).

Juiciness

Significant differences ($P < 0.05$) in juiciness were recorded, with Balangu achieving the highest score (5.37) and Dambun Nama the lowest (4.27). Balangu's slow-roasting process likely contributed to greater moisture retention, enhancing succulence and mouthfeel. In contrast, the intensive drying of Dambun Nama removed free water, leading to a drier product. Kilishi's moderate juiciness score (4.70) suggests a balance between preservation via drying and retention of residual fat and moisture. Juárez *et al.* (2012) and Xia *et al.* (2021) have demonstrated that cooking methods and temperatures directly affect lipid retention and water-holding capacity, which are essential for juiciness perception.

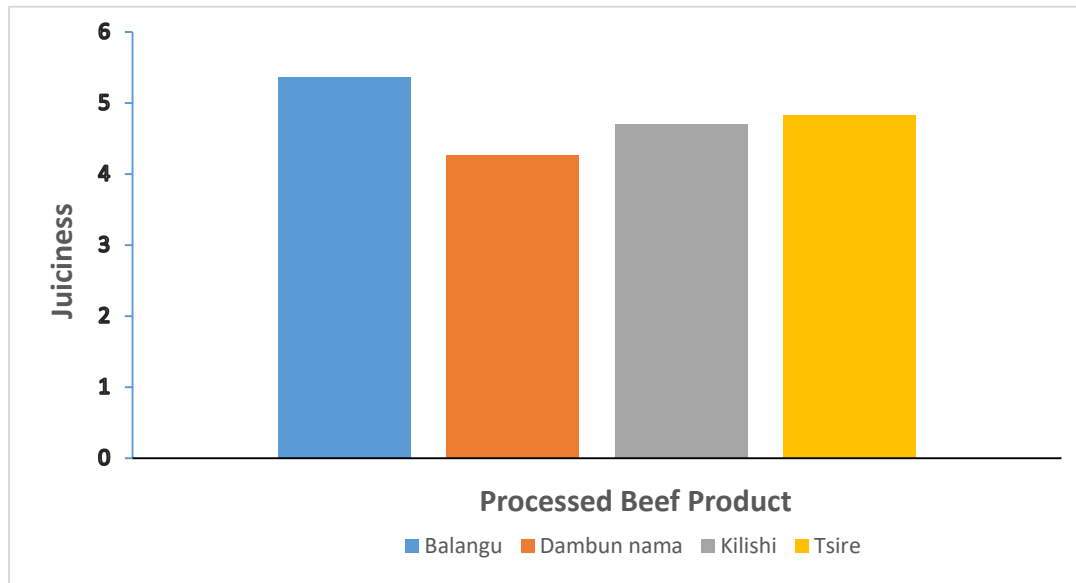


Figure 4: Juiciness preference of processed beef product

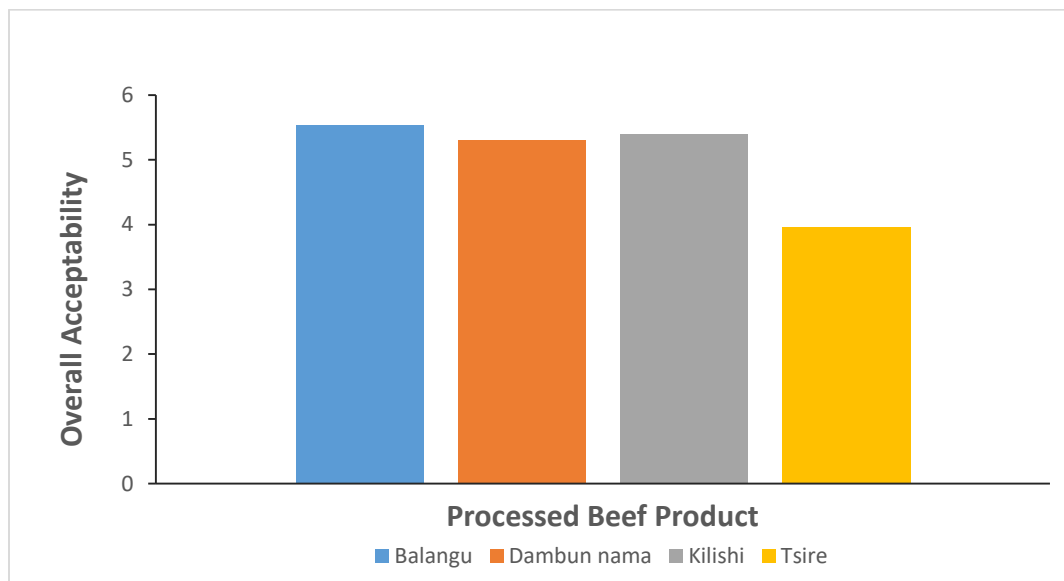


Figure 5: Overall acceptability of processed beef products

Acceptability

Overall acceptability scores reflected the combined influence of other sensory attributes, with Balangu rated highest (5.53) and Tsire lowest (3.97). Panelists appeared to favour products with high juiciness, moderate tenderness, and balanced flavour,

characteristics embodied by Balangu. Tsire's lower score may be attributed to its drier texture and comparatively lower flavour perception, consistent with the observation that excessive grilling reduces consumer appeal (Troy and Kerry, 2010). These results support the findings of Kehlet *et al.* (2017) that

juiciness, flavour, and tenderness collectively determine consumer acceptance.

CONCLUSION

In conclusion, Balangu emerged as the most preferred product overall, which might be associated to its superior juiciness, high tenderness, and balanced flavour recorded. Dambun Nama excelled in flavour but had lower tenderness and juiciness. Kilishi maintained good tenderness but scored lowest in

flavour while Tsire was the least accepted product, potentially due to its tougher texture. This study therefore demonstrated that the sensory qualities of traditionally processed beef products in Mubi vary significantly with the processing method. While colour was unaffected by the different preparation techniques, significant differences were observed in flavour, tenderness, juiciness, and overall acceptability.

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