# PHYSICAL MEAT QUALITY OF IMPALA (*AEPYCEROS MELAMPUS*) RAMS AS INFLUENCED BY PRODUCTION SYSTEM

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## I. INTRODUCTION

Game meat is a sustainable resource that may contribute to the food security of South Africa [1]. The South African game industry has expanded significantly, resulting in use of intensive, semi-extensive and extensive systems to improve animal production, particularly for high value game and colour variants with superior genetics [2]. This has resulted in a surplus of splits ($F_1$) and colour variants with inferior genetics, which are culled for meat. A popular choice for breeding of colour variants is the impala, a southern African antelope that is also favoured for its meat [3]. Impala have a wide distribution, rapid reproductive rate and relative abundance as a species that make them ideal for sustainable cropping regimes [4, 5]. However, the effect of extrinsic factors such as production system on the meat quality of impala have not yet been determined. The research objective was to quantify the influence of different production systems on the physical meat quality of impala in order to provide baseline data for the game industry. This data may be used to establish whether impala meat products will meet modern consumer requirements and to increase the production, sale and consumption of South African game meat.

## II. MATERIALS AND METHODS

Twelve sub-adult (±15 months) male impala per production system (intensive, semi-extensive and extensive; *n*=36) were culled using light caliber rifles. The intensive (all feed supplied) and semi-extensive (supplementary feed, primary feed natural vegetation) production systems were located in the Modimolle region of Limpopo and the extensive (only natural vegetation) production system was located near Bredasdorp in the Western Cape province of South Africa. After shooting, the impala were exsanguinated, skinned and eviscerated according to South African standard operating procedures. Carcasses were hung in a cold room set to 4°C for 24 hours, after which the *M. longissimus thoracis et lumborum* (LTL) muscles were removed and subjected to physical analysis. The physical attributes ($pH_u$, colour, moisture loss and tenderness) of the LTL muscles were recorded using the methods described by Honikel [6]. Resulting data was analysed with SAS software (Version 9.4; SAS Institute Inc., Cary, USA), using the General Linear Models procedures to perform a univariate analysis of variance (ANOVA) after removal of outlier animals.

## III. RESULTS AND DISCUSSION

The results are presented in Table 1. Highly significant differences ($p < 0.0001$) were observed between the different production systems. The meat $ph_u$ was the highest in extensive system impala, followed by the intensive and semi-extensive systems. Water holding capacity was found to be the lowest in the intensive system, which produced meat with the highest drip and cooking loss percentages. Meat tenderness (as determined by shear force) differed significantly between the three systems, with the most tender meat produced by the semi-extensive production system, followed by the extensive system and lastly the intensive system, which produced the least tender meat. Decreased tenderness and water holding capacity may be the result of ante-mortem stress caused by close human proximity in the small confines of the intensive system during culling. However, sub-adult impala rams from all production systems produced tender meat overall, as indicated by shear force values < 43 N [7].

As pertaining to the surface colour of meat, the extensive system produced meat was significantly darker and less red with a lower chroma value than that of the other two production systems. Darker meat may be the

result of ante-mortem stress or increased physical activity in the extensive system producing more myoglobin in the muscle [8]. Impala meat from the semi-extensive system had significantly higher yellowness index values than meat from the extensive system, while the intensive system did not differ significantly from either of the other two systems. No significant differences were noted between the three production systems with meat hue-angle.

Table 1 LSMean (± SE) of impala LTL physical meat quality parameters as influenced by production system

| | Production system | | | |
|---|---|---|---|---|
| Parameter | Intensive | Semi-extensive | Extensive | p-value |
| $pH_u$ | $5.8^{b} \pm 0.05$ | $5.6^{c} \pm 0.05$ | $6.2^{a} \pm 0.06$ | < 0.0001 |
| Drip loss (%) | $2.2^{a} \pm 0.12$ | $1.5^{b} \pm 0.12$ | $0.9^{c} \pm 0.14$ | < 0.0001 |
| Cooking loss (%) | $36.8^{a} \pm 0.65$ | $29.5^{b} \pm 0.68$ | $28.1^{b} \pm 0.79$ | < 0.0001 |
| Shear force (N) | $39.3^{a} \pm 1.85$ | $22.4^{c} \pm 1.94$ | $29.0^{b} \pm 2.27$ | < 0.0001 |
| Colour | | | | |
| Lightness index (L*) | $30.9^{a} \pm 0.70$ | $32.2^{a} \pm 0.73$ | $26.8^{b} \pm 0.85$ | 0.0001 |
| Redness index (a*) | $11.4^{a} \pm 0.34$ | $12.2^{a} \pm 0.35$ | $10.0^{b} \pm 0.41$ | 0.0015 |
| Yellowness index (b*) | $6.0^{ab} \pm 0.51$ | $7.1^{a} \pm 0.53$ | $5.2^{b} \pm 0.62$ | 0.0746 |
| Chroma | $13.1^{a} \pm 0.46$ | $14.2^{a} \pm 0.49$ | $11.4^{b} \pm 0.57$ | 0.0026 |
| Hue-angle | 27.8 ± 1.65 | 29.4 ± 1.73 | 27.5 ± 2.03 | 0.7322 |

$^{abc}$*Means in the same row with different superscripts differ significantly at p ≤ 0.05*

## IV. CONCLUSION

The results from this study showed that production system significantly influences impala meat quality, with extensive system producing darker, less red meat and semi-extensive producing the more tender meat. However, sub-adult impala rams from all production systems produce meat with desirable physical quality. These results may aid in marketing and promotion of impala meat products. Further research is recommended to determine the effect of production system on sensory and chemical meat quality.

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