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THE EFFECT OF CASTRATION AND CASTRATION METHOD ON THE GROWTH PERFORMANCE AND MEAT QUALITY OF SOUTH AFRICAN BOER GOATS

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I. INTRODUCTION

The common perception regarding a species-specific 'goaty' flavour and aroma of goat meat, in particular from older male animals, has been the reason for the reluctance of many consumers to buy goat meat, along with goat meat being rarely available in South African retail stores [1][2]. The 'goaty' flavour in goat meat is presumably due to specific branched-chain fatty acids (4-methyloctanoic and 4-ethyloctanoic acid) possibly influenced by age and sex [3]. Thus, the reduction of testosterone by physical and/or immunocastration should reduce the goaty flavour and aroma of goat meat. In addition, because goats tend to deposit fat later in their growth cycle than sheep [3], intensive feeding for pre-slaughter conditioning on high-energy/protein diets may further enhance the eating quality of goat meat [4].
This study investigated the effects of the castration method and extended feeding of a concentrate diet on the growth, carcass yield and sensory profile of SA Boer goats.

II. MATERIALS AND METHODS

Ethical approval for the study was obtained from the Animal Care and Use (REC) Ethical Committee of Stellenbosch University (reference number ACU-2023-27474). SA Boer goat males (between 3.5 and 4.5 months of age; 24 kg) were castrated using either: Burdizzo emasculator (physical castration; n=15), Improvac® vaccine (immunocastration; 2ml/animal at start and repeated twice with 4-week intervals; n=15), while an intact group served as a control (n=15). The goats were fed a pelleted grain/lucerne and oil-cake-based diet (dry matter: crude protein = 15.3%), for 84 days and housed in individual pens. Animals were slaughtered a commercial abattoir after overnight lairage. Warm and cold carcass and (chilled overnight at 3 ±3 °C) weights were recorded. The left loin muscle (*longissimus thoracis et lumborum,* LTL muscle with bones) were sampled from each carcass and used for descriptive sensory analysis. For training (5 days prior to testing) of panellists and sensory analyses, LT and LL portions were roasted uncovered, with bone and subcutaneous fat still intact, in a preheated (163 ± 1°C) industrial oven (Hobart, Paris, France) according to American Meat Science Association (AMSA) [5] guidelines to an internal temperature of 71 ± 1°C. Three cubes of meat per sample were individually wrapped, labelled with a unique code, tasted and scored by a ten-member trained sensory panel. Intensity rating of each attribute (Table 1) was done using a 100-point unstructured line scale with anchor words.
Data was analysed using a linear mixed-effects model approach with the castration method as a fixed effect and animal and/or carcass/taste sample as random effects using SAS software (Version 9.4, SAS Institute Inc., Cary, USA). Post hoc Fisher's LSD multiple comparisons were used to determine differences between treatments.

III. RESULTS AND DISCUSSION

Intact animals gained weight faster ($p < 0.001$) and more efficiently ($p = 0.011$) and therefore produced heavier slaughter animals ($p = 0.001$) with higher carcass weights ($p = 0.003$) than animals in the two castrated groups. The comparison of intact and Burdizzo castrated animals agree with the results of El-Waziry et al. [6] who attributed the differences to higher testosterone in intact animals. The testes circumference of intact goats increased from 21 cm to 31 cm over the growth period showing sexual development towards puberty (data not displayed) compared to final testes circumference values of 21.5 cm and 19 cm for Improvac® and Burdizzo groups, respectively ($p < 0.001$). Needham et al. [7][8] reported that a Improvac® decreased scrotal circumference, reduced serum testosterone concentrations but had no effect on growth performance or cold carcass weight and carcass yield compared to intact of Dohne Merino lambs, although both burdizzo castrated and immunocastrated lambs produced carcasses with higher fat thickness than intact lambs. In the current study, castration and castration method had no effect back fat thickness of goats (Table 1). The critical point on a growth curve where

the rate of fat deposition is faster than muscle growth for most sheep breeds is between 20 and 42 kg, while goats are expected to reach this point at body weights of higher than 50 kg.

Table 1: Effect (Mean ± SEM) of castration method on growth parameters of SA Boer goats after a 12-week feedlot finishing period, selected carcass and meat characteristics and sensory quality of *longissimus* muscle

Parameters	Treatment			Pr > F
	Intact	Burdizzo	Improvac®	
Average daily gain, kg	0.32^{a} ± 0.008	0.26^{b} ± 0.008	0.26^{b} ± 0.008	<0.001
Feed conversion ratio, kg/kg	5.00^{a} ± 0.148	5.49^{b} ± 0.153	5.63^{b} ± 0.148	0.011
Slaughter weight, kg	51.85^{a} ± 1.324	44.94^{b} ± 1.371	45.60^{b} ± 1.324	0.001
Testis circumference, cm	31.0^{a} ± 0.424	19.05^{b} ± 0.511	21.50^{b} ± 0.324	<0.001
Cold carcass weight, kg	24.28^{a} ± 0.670	21.83^{b} ± 0.700	20.84^{b} ± 0.670	0.003
Back fat thickness, mm	2.74 ± 0.212	2.94 ± 0.219	2.52 ± 0.212	0.397
Loin muscle fat, %	3.38 ± 0.151	3.76 ± 0.156	3.67 ± 0.151	0.194
Meaty flavour	70.78 ± 0.370	71.79 ± 0.428	70.45 ± 0.435	0.073
'Goaty' flavour	19.81^{a} ± 0.750	17.90^{b} ± 0.409	16.89^{b} ± 0.531	0.004
Sustained juiciness	69.36 ± 0.904	69.54 ± 0.808	68.51 ± 0.851	0.665
Tenderness	70.82 ± 0.968	70.49 ± 1.265	70.76 ± 1.069	0.976

$^{a-b}$ Means in rows with different superscripts differ (P < 0.05. SEM = standard error of mean. Scores on a 100-point unstructured line scale with anchor words: 0 = none, extremely dry or not tender; 100 = prominent, extremely juicy or tender.

No effect of castration and castration method was found for any aroma (data not displayed) or flavour, juiciness or tenderness, except that 'goaty' flavour' (but not 'goaty' aroma) was scored higher for intact animals (p = 0.004) in agreement with Aung et al. [9] but the low scores and small differences are probably due to the young age of the goats and could be expected to increase at higher maturity [2][10].

IV. CONCLUSION

Immunocastration proved to have the same effect on growth and carcass characteristics as burdizzo castration and could effectively be used on goats as a less invasive or painful castration method. Intact goats will grow faster and more efficiently and produce larger carcasses than castrated animals and will have acceptable carcass fatness levels at slaughter when exposed to extended feeding of a concentrate diet, i.e. longer than sheep (lambs). Furthermore, the intact goats will produce acceptable meat quality in terms of flavour, tenderness and juiciness, comparable to castrated animals with a small risk of off-flavours.

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