

**Meat quality of selected Ethiopian goat genotypes under
varying nutritional conditions.**

By

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I dedicate this thesis to the almighty GOD

who

gave me the strength and patience to complete this study.

Declaration

I hereby declare that this thesis submitted by me to the University of Pretoria for the degree of PhD (Animal Science) (Meat Science) has not previously been submitted for a degree at any other University.

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ABSTRACT

Meat quality of selected Ethiopian goat genotypes under varying nutritional conditions

By

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The study evaluated the effects of genotype and grainless diets under stall-fed (n=72) conditions on the following parameters using the Afar, Central Highland goats, (CHG) and Long-eared Somali, (LES) goats. The diets varied in concentrate: roughage ratios. Diet 1 was a 50: 50 ratio (8.5 MJ ME/kg DM), Diet 2, 65:35 (9.2 MJ ME/kg DM) and Diet 3 an 80:20 ratio (10 MJ ME/kg DM), respectively. The same genotypes reared under the extensive grazing systems were also evaluated.

Intake, feed efficiency (FE) and rumen parameters

Total DMI ranged between 2.6 and 3.0 % on a body weight basis and between 53.5 and 62.3 g per kg metabolic body weight. The LES had a higher ($P<0.001$) DM roughage intake, total DMI ($P<0.01$) and FE ($P<0.05$). Goats on Diet 3 had higher ($P<0.001$) total DMI (g/d). Diet 1 however, displayed higher ($P>0.05$) FE. The mean concentration of $\text{NH}_3\text{-N}$ (39.4-53.7 mg/100ml rumen fluid) was above the N requirements for optimal microbial activity. The mean pH was similar between diets and ranged from 6.43 to 6.63. Total VFA was depressed ($P<0.01$) with increased grainless concentrate in the diet. Diet 1 recorded a higher ($P<0.01$) total VFA and lower ($P<0.01$) $\text{NH}_3\text{-N}$ concentration, indicating that feed

nitrogen was more efficiently utilized in Diet 1. The molar proportions of acetate, propionate and butyrate varied ($P>0.05$) from 64.5 to 65.7, 17.7 to 18.8 and 10.7 to 12.8 %, respectively. The ratio of acetic: propionic was not affected by diet ($P>0.05$) and ranged from 3.5 to 3.81. The values for degradation constants were similar ($P>0.05$) between the diets. However, the hay DM and neutral detergent fibre were more degradable ($P<0.05$) in goats fed Diet 1. Differences in DMI and FE between the genotypes were recorded with the LES breed being superior. Among the grainless diets, the 50:50 ratio created a favorable rumen environment and resulted in a better FE under a feedlot system.

Carcass characteristics and meat quality of extensively managed goats

Genotypes were similar ($P>0.05$) for most of carcass traits, at an average slaughter weight of 13.8 kg. The genotypes had a mean hot carcass weight of 5.9 kg and a dressing percentage (DP) on a slaughter body weight basis of 42.8 %. The CHG had a 52 % higher ($P<0.01$) chilling loss than the other genotypes. The rib physical composition was similar between genotypes, except for fat proportion. The CHG had the lowest ($P<0.05$) fat proportion. The chemical composition was similar between the genotypes, with the CHG having the lowest ($P>0.05$) chemical fat percentage.

The composition of most muscle fatty acids was affected by genotype. The LES breed presented a beneficial ratio of n-6: n-3 PUFA favorable to consumers' health. The goats under the extensive system in general, were characterized by a lower carcass weight and poor carcass fat cover. Hence, to improve the carcass characteristics it is essential that grazing goats should be supplemented or stall-fed with locally available concentrates depending on the grazing resources of the agro-ecologies and the objectives of the goat farmers.

Growth and carcass characteristics of stall-fed goats

The LES breed had significantly higher growth rates (ADG), heavier pre-slaughter, slaughter, empty body weight (EBW) and carcass weights than the Afar and CHG goats.

Effect of diet was also significant on ADG, but similar for carcass traits, except for DP on EBW basis and some non-carcass components. The DP on an EBW basis, was the highest ($P<0.01$) for Diet 1. Stall-feeding of the goats improved the mean carcass weight by 38 % over the initial slaughtered groups. Genotype affected the DP and it ranged from 42.5 to 44.6 % and 54.3 to 55.8 % on a slaughter weight and on EBW basis, respectively. The ultimate carcass pH was between 5.61 and 5.67 and chilling losses ranged from 2.5 to 3.1 %. The rib physical composition (fat and bone) differed between genotype and ranged from 72-73 %, 6.9-10.9 % and 17.1-20.2 % for muscle, fat and bone respectively. The findings indicate that breed differences were reflected in carcass characteristics.

Meat quality of stall-fed goats

Genotype significantly influenced the carcass fat and crude protein (CP) concentration, with the values ranging from 10.3 to 14.0 % and 19.3 to 21.1%, respectively. The Afar and LES goats had higher fat concentration ($P<0.001$) compared to the CHG while the CP was higher ($P<0.01$; $P<0.05$) for the CHG. The effect of diet was significant on CP %, but was similar for fat concentration although Diet 3 tended to have a higher value. Cooking and drip loss differed ($P<0.01$, $P<0.05$) between genotypes and both traits increased with increased fatness. The effect of diet however, was similar for cooking and drip loss. Genotype and diet significantly influenced the composition of most muscle fatty acids. An interaction between genotype and diet was also exhibited on certain fatty acids. Compared to CHG, Afar and LES breeds had a higher PUFA, MUFA and UFA: SFA ratio, which are considered healthier for human consumption due to their lowering effect of cholesterol content. The relatively higher carcass fat, which is useful in reducing chilling loss and improves eating quality, the absence of C12:0 and lower concentration of C14:0, hypercholesterolemic, and higher C18:1, hypocholesterolemic fatty acids, are some of the important traits observed in

Ethiopian goats. These findings suggest that a potential exists in the use of Ethiopian goat breeds fed a grainless diet, for the production of meat with specific quality characteristics.

Keywords: Indigenous Ethiopian goats; growth; carcass yield and composition; meat chemical composition and long chain fatty acid; intake; feed efficiency; rumen parameters; grainless diet.

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