# Meat and Fatty acid composition of Chevon from Goats supplemented with *Moringa oleifera* leaf meal

**Moyo, B.[1], Masika, P. J. [2], Hugo, A.[3] and Muchenje, V.[1]**

[1*] Department of Livestock and Pasture Science, University of Fort Hare, P. Bag X1314, Alice 5700, South Africa
[2]Agricultural and Rural Development Research Institute (ARDRI), University of Fort Hare, P. Bag X1314, Alice 5700, South Africa
[3]Department of Microbial Biochemical and Food Biotechnology, University of Free the State, P.O Box 339, Bloemfontein, 9300, South Africa

*Abstract*— **The objective of the study was to determine the fatty acid composition of meat from 24 crossbred Xhosa lop-eared goat castrates supplemented with *Moringa oleifera* leaves (MOL), sunflower seed cake (SC) and grass hay (GH). After slaughter, the *Muscularis longissimus thoracis et Lumborum* (LTL) of the right side was sampled for fatty acids composition analyses. Fatty acids were quantified and identified using the methylation and Varian GX 3400 flame ionization GC. Twenty-five fatty acids were identified in lipids that were extracted from LTL muscle. It was primarily composed of C18:1c9, followed by C16:0 and C18:0 in decreasing order of proportion. Chevon from SC supplemented group had higher (P < 0.05) C18:1c9 (46%) than GH group (33%). The values for C16:0 (21%) and C18:0 (17 to 18%) were not significantly different among three dietary groups. Chevon from GH group had higher (P < 0.05) proportions of PUFA (18.93%), SFA (47.91%), *n*-6 (11.35%) and *n*-3 (7.58%) fatty acids profiles than MOL and SC group. The higher (P < 0.05) PUFA/SFA ratio was recorded in GH group (0.40) while *n*-6/*n*-3 ratio was higher in SC (2.17) and MOL (1.39) than GH group (1.5). The fatty acid composition varied with the diet with MOL group having higher levels of C18:1c9, C16:0 and C18:0.**

*Keywords*— **Chevon, n-6/n-3 ratio, fatty acid profile**

## I. INTRODUCTION

Goat meat has played a vital role, in helping to alleviate poverty and improve nutrition, especially for the resource-limited farmers, however meat fatty acid composition are known to be influenced by genotype, age, sex, diet and production methods (Ding et al.,2010) [1]. Recently, consumers have increased preference for eating lean meat that does not adversely affect their health (Muchenje et al., 2009 [2]. Chevon has low levels of lauric, myristic and palmitic acids, which are associated with the biosynthesis and deposition of cholesterol (Adrizzo et al., 1999 [3]. The quality of fatty acids is assessed using ratios of polyunsaturated fatty acids to saturated fatty acids (PUFA/SFA) and *n*-6/*n*-3 (Alfaia et al., 2006) [4].

Farmers have developed ways to manipulate the fatty acid composition of meat so as to produce healthier meat with a higher ratio of polyunsaturated to saturated fatty acids (Wood et al., 2004) [5]. One way to achieve this is by manipulating the diet by using forage plants. One such forage plant is *Moringa oleifera* which have higher nutritive value, however, its effect on chevon fatty acid profile when used as goat supplement is unknown in South Africa. The objective of the study was to determine fatty acid composition of meat from goats supplemented with *Moringa oleifera* leaves (MOL), sunflower seed cake (SC) or grass hay (GH).

## II. MATERIALS AND METHODS

Twenty-four 8 months old castrated Xhosa lop-eared goats were allocated to three dietary supplements of *M. oleifera* leaf meal (MOL), sunflower seed cake and grass hay (GH). They were supplemented at the University of Fort Hare farm. The MOL group were offered 200g of *M. oleifera* dry leaves while SC group received 170g sunflower seed

cake. Grass hay was offered to all groups *ad-libtum*. After 60 days, goats were slaughtered in a commercial Adelaide abattoir using the electric stunning method. The *M. longissimus thoracis et lumborum* (LTL) of the right hand side was sampled, 24 hours after slaughter for fatty acid analysis. Total lipids in individual groups were extracted according to AOAC (2005) [6] procedures for fatty acids determination as described by Mapiye et al. (2011) [7]. Total muscle lipids were quantitively extracted, according to the method of Folch et al. (1957) [8]. Fatty acid esters (Fame) were prepared for gas chromatography according to Christe et al., 2001) [9]. Fatty acids were then expressed as the proportion of each individual fatty acid to the total fatty acid present in the sample. Then fatty acid combinations and ratios were calculated: omega-3 (*n*-3) fatty acids, omega-6 (*n*-6) fatty acids, total saturated fatty acids (SFA), total monosaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA), PUFA/SFA ratio (P/S) and *n*-6/*n*-3 ratio. The effect of diet on fatty acid composition was analyzed using GLM procedures of SAS (2003) [10]. Differences between least-square means were compared using the PDIFF procedure of SAS (2003) [10].

## III. RESULTS AND DISCUSSION

As shown in Table 1 the C18:1c9, C16:0 and C18:0 fatty acids were dominant across different groups is consistent with previous reports (Mushi et al., 2010 [11]. The SFA level were higher in GH which could be attributed higher forage intake in GH group (Vasta et al., 2009) [12]. Higher forage intake increases rumen activity, consequently increasing the extent of biohydrogenation of dietary PUFA by rumen microbes. The ratios of PUFA/SFA were lower in SC group than MOL and GH. This could be attributed to the hydrogenation of dietary unsaturated fat in the rumen which is responsible for a decrease in the PUFA to SFA ratio in muscle of all ruminants compared to non-ruminants (Talpur et al., 2008) [13]. Hoffman and Wiklund (2006) [14] reports that higher PUFA/SFA is desirable. The *n*-6/*n*-3 ratio in Table 1 was lower in MOL and GH groups, making it an ideal for preventing cardiovascular diseases (Muchenje et al., 2009) [2]. The low *n*-6/*n*-3 ratios are desirable for chevon consumers' health reasons Department of Health, 1994 [15].

**Table 1**. Least square means and standard errors of fatty acid composition in percentage fatty acids from the *longissimus thoracis et lumborum* muscle of cross-bred Xhosa lop eared goats given three different diets

| Fatty acid (% total fatty acid) | GH | MOL | SC | S.E |
|---|---|---|---|---|
| N | 8 | 8 | 8 | |
| C12:0 | 0.10 | 0.07 | 0.06 | 0.21 |
| C14:0 | 1.78$^{a}$ | 1.80$^{a}$ | 2.52$^{b}$ | 0.107 |
| C15:0 | 0.62$^{b}$ | 0.42$^{a}$ | 0.49$^{a}$ | 0.028 |
| C16:0 | 21.72 | 21.55 | 21.64 | 0.470 |
| C17:0 | 1.40 | 1.28 | 1.38 | 0.068 |
| C18:0 | 19.21 | 18.23 | 17.30 | 0.726 |
| C20:0 | 0.21$^{b}$ | 0.08$^{a}$ | 0.06$^{a}$ | 0.006 |
| C21:0 | 1.94$^{b}$ | 0.64$^{a}$ | 0.70$^{a}$ | 0.059 |
| C22:0 | 0.93$^{b}$ | 0.42$^{a}$ | 0.49$^{a}$ | 0.021 |
| Total SFA | 47.91 | 44.49 | 44.64 | 0.998 |
| C14:1c9 | 0.06 | 0.06 | 0.07 | 0.007 |
| C16:1c9 | 1.67$^{a}$ | 1.87$^{a}$ | 2.13$^{b}$ | 0.084 |
| C17:1c10 | 0.02 | 0.23 | 0.09 | 0.009 |
| C18:1c11 | 0.17 | 0.15 | 0.18 | 0.011 |
| C18:1c9 | 33.45$^{a}$ | 41.24$^{b}$ | 46.12$^{b}$ | 1.319 |
| C18:1t11 | 1.25 | 1.16 | 1.18 | 0.021 |
| Total MUFA | 36.62$^{a}$ | 44.71$^{b}$ | 49.77$^{b}$ | 1.174 |
| C18:2c9,12(*n*-6) | 5.11$^{b}$ | 3.52$^{a}$ | 3.02$^{a}$ | 0.219 |
| C18:3c9,12(*n*-6) | 0.03 | 0.03 | 0.04 | 0.003 |
| C18:2c9t11(*n*-6)(CLA) | 0.15$^{b}$ | 0.12$^{a}$ | 0.11$^{a}$ | 0.006 |
| C20:2c11,14(*n*-6) | 0.55 | 0.51 | 0.49 | 0.024 |
| C20:3c8,11,14(*n*-6) | 0.03 | 0.02 | 0.01 | 0.002 |
| C20:4c5,8,11,14(*n*-6) | 5.45$^{c}$ | 3.59$^{b}$ | 1.65$^{a}$ | 0.184 |
| C22:2c13,16(*n*-6) | 0.03 | 0.02 | 0.01 | 0.010 |
| Total *n*-6 | 11.35$^{b}$ | 7.81$^{a}$ | 5.33$^{a}$ | 0.802 |
| C20:3c11,14,17(*n*-3) | 0.55$^{b}$ | 0.32$^{a}$ | 0.23$^{a}$ | 0.018 |
| C20:5c5,8,11,14,17(*n*-3) | 3.13$^{b}$ | 2.79$^{b}$ | 1.01$^{a}$ | 0.131 |
| C22:6c4,7,10,13,16,19(*n*-3) | 0.62$^{b}$ | 0.23$^{a}$ | 0.21$^{a}$ | 0.032 |
| C22:5c7,10,13,16,19(*n*-3) | 3.28$^{b}$ | 2.29$^{b}$ | 1.01$^{a}$ | 0.083 |
| Total *n*-3 | 7.58$^{b}$ | 5.63$^{b}$ | 2.46$^{a}$ | 0.617 |
| Total PUFA | 18.93$^{c}$ | 13.44$^{b}$ | 7.79$^{a}$ | 0.467 |
| PUFA/SFA | 0.41$^{b}$ | 0.30$^{b}$ | 0.17$^{a}$ | 0.014 |
| PUFA/MUF | 0.52$^{b}$ | 0.30$^{b}$ | 0.16$^{a}$ | 0.014 |

| | | | | |
|---|---|---|---|---|
| A | | | | |
| *n*-6/*n*-3 | 1.50[a] | 1.39[a] | 2.17[b] | 0.080 |

[abc] Means in the same row, with different superscript differ significantly (P< 0.05)

## IV. CONCLUSION

Supplementation of goats with GH and MOL diets provided chevon with desirable fatty acids especially the *n*-6/*n*-3 ratio than goats supplemented with SC diet. Therefore, chevon from goats supplemented with MOL could be a healthy nutritious food from a human nutrition perspective.

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