FATTY ACID COMPOSITION OF SEVEN SOUTH AFRICAN BEEF BREEDS

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I. INTRODUCTION

Intramuscular fat (IMF) content of lean beef is low at between 2 and 5 % and this "low in fat" property plays a vital role in many quality traits of meat. There are many factors which contribute to the intramuscular fat content and intramuscular fatty acid composition beef cattle, such as gender, age and feeding regime [1]. Intramuscular fat content and composition will also differ significantly between muscle types and between different breeds [2]. In this study the intramuscular fat content and intramuscular fatty acid composition of seven South African beef breeds raised under similar conditions in feedlots will be compared.

II. MATERIALS AND METHODS

Ten weaner bull calves from each of the Brahman, Afrikaner, Bonsmara, Simbra, Angus, Simmentaler and Limousin breeds were sourced at an average weight of 230 kg and raised under similar conditions in a feedlot. Animals were slaughtered when the breed group reached an average A2 carcass classification. A three-rib cut containing the *M. Longissimus thoracis* was removed from the left side of the carcass between the 9th and 12th rib [3]. A muscle sample was removed at this position and used for lipid extraction and fatty acid analysis with a gas chromatograph. Data was statistically analyzed to determine breed differences.

III. RESULTS AND DISCUSSION

Levels of intramuscular fat were generally very low and no significant differences in intramuscular fat was observed between breeds. (Table1). The very low intramuscular fat content can be attributed to the young age of the animals at slaughter. Several significant breed differences were observed in intramuscular fatty acid composition (Table 1). The Limousine breed demonstrated higher levels of the saturated fatty acids such as palmitic acid and stearic acid compared to breeds such as the Simbra and Brahman. The Brahman had significantly higher levels of phytanic acid compared to the Bonsmara. The Simbra had significantly higher levels of oleic acid compared to the Limousine and Afrikaner. The Afrikaner had significantly higher levels of the polyunsaturated linoleic acid compared to other breeds. The Brahman had the highest level of conjugated linoleic acid. The Afrikaner breed had the highest content of omega-6 and omega-3 fatty acids while the Angus breed had the lowest and therefore the better [4] omega-6 to omega-3 ratio.

Principal component analysis (Figure 1) demonstate a relationship between fatty acid profile and breeds. The *Bos Taurus* breeds (Simmentaler, Angus and Limousine) clustered on the left hand side of the plot while *Bos indicus* (Brahman) and the related *Bos taurus indicus* (Simbra) clustered on the right hand side of the plot. *Bos taurus africanus* (Bonsmara) clustered between the *Bos taurus* and *Bos indicus* breeds. The *Bos taurus africanus* (Afrikaner) formed a cluster on the far right bottom corner of the principal component analysis plot.

IV. CONCLUSION

Although factors such as gender, age and feeding regime have an effect on the fatty acid profile of beef it is clear that there is also a breed effect under similar production and feeding conditions. This research also indicated that related beef breeds clustered in terms of fatty acid composition and fatty acid ratios.

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Table 1 Intramuscular fat content and fatty acid profile of seven beef breeds.

Breed	Afrikaner	Angus	Bonsmara	Brahman	Limousine	Simbra	Simmentaler	Sign. level
Proximate composition:								
% Intramuscular fat	1.28	2.04	1.40	1.60	1.43	1.56	1.81	p = 0.055
Fatty acid composition (%)								
Common name:								
Myristic	3.69^{ab}	3.19^{a}	3.79^{ab}	4.26^{b}	3.18^{a}	3.16^{a}	3.24^{a}	p = 0.001
Palmitic	30.81^{ab}	31.02^{ab}	31.98^{b}	31.71^{ab}	32.03^{b}	28.10^{a}	29.66^{ab}	p = 0.026
Phytanic	0.01^{ab}	0.02^{ab}	0.01^{a}	0.04^{b}	0.01^{ab}	0.02^{ab}	0.03^{ab}	p = 0.015
Stearic acid	19.88^{ab}	20.20^{ab}	20.50^{ab}	18.01^{a}	21.82^{b}	19.66^{ab}	20.42^{ab}	p = 0.035
Oleic	31.40^{a}	33.87^{ab}	32.32^{ab}	33.73^{ab}	31.46^{a}	36.34^{b}	35.71^{ab}	p = 0.010
Vaccenic	0.99	1.66	1.12	1.44	1.38	1.35	0.98	p = 0.477
Linoleic	6.61^{b}	4.03^{a}	4.15^{a}	4.06^{a}	4.24^{a}	4.57^{a}	4.07^{a}	p = 0.001
α-Linolenic	0.35^{b}	0.33^{b}	0.29^{ab}	0.29^{ab}	0.23^{a}	0.31^{b}	0.30^{ab}	p = 0.001
Conjugated linoleic acid (CLA)	0.19^{bc}	0.18^{abc}	0.13^{ab}	0.24^{c}	0.10^{a}	0.20^{bc}	0.14^{ab}	p < 0.001
Arachidonic	0.79^{b}	0.40^{a}	0.37^{a}	0.43^{a}	0.38^{a}	0.43^{a}	0.29^{a}	p = 0.001
Fatty acid ratios								
Total n-6 fatty acids	7.70^{b}	4.67^{a}	4.67^{a}	4.79^{a}	4.77^{a}	5.28^{a}	4.55^{a}	p = 0.001
Total n-3 fatty acids	0.43^{c}	0.38^{bc}	0.31^{ab}	0.32^{ab}	0.26^{a}	0.34^{abc}	0.31^{ab}	p = 0.001
n-6/n-3	17.76^{b}	12.22^{a}	15.08^{ab}	15.06^{ab}	18.28^{b}	15.41^{ab}	14.74^{ab}	p = 0.001

Means with different superscripts in the same row differ significantly.

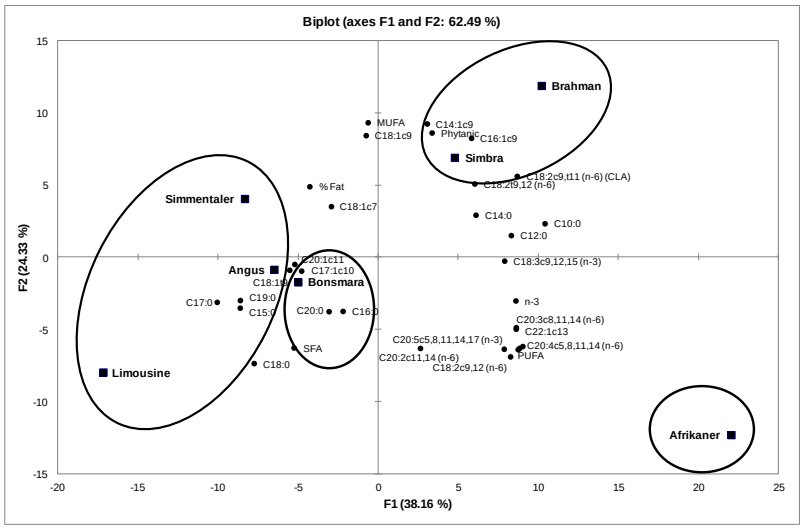

Figure 1. Principal Components Analysis of the intramuscular fat content and fatty acid composition of seven South African beef cattle breeds

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