THE EFFECT OF SOYBEAN-SUNFLOWER OIL BLEND AND ANTIOXIDANT SUPPLEMENTATION IN FEEDLOT LAMB DIETS ON SENSORY QUALITY

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I. INTRODUCTION

Feedlot lamb diet can be supplemented with plant-based oils to increase the energy density of the diet and to improve feedlot growth parameters and feed efficiency. In addition, plant-oil supplements could lead to changes in the fatty acid profile of intramuscular and subcutaneous fat [1]. Subsequent changes in the fatty acid profile could have a direct impact on the sensory quality and related physical measurements of lamb meat quality. The general increase in the concentration of fat present in the final product may lead to higher susceptibility to lipid oxidation [1], [2]. Adding antioxidants to the animal feed can contribute to flavour enhancement and potentially reduce the rate of lipid oxidation of the final product [1], [3]. Different types of antioxidants exhibit different degrees of potency. Synthetic antioxidants such as ethoxyquin (EQ, 6-ethoxy-1,2-dihydro-2,2,4-trimethylquinoline), BHT (butylated hydroxytoluene), and BHA (butylated hydroxyanisole) are commonly incorporated into animal feed and show high levels of antioxidant capacity, but there is a drive to replace synthetic antioxidants with natural alternatives [1]. The objectives of this study were firstly, to determine the effect of the soybean-sunflower oil blend on the sensory quality of the final lamb meat product. Secondly, to determine if there is a difference in sensory quality of the subcutaneous fat aroma and meat aroma and flavour with the inclusion of antioxidants (natural and synthetic antioxidants), in comparison to no antioxidant supplementation in the diet in combination with the oil blend.

II. MATERIALS AND METHODS

Uncastrated male Dohne Merino lambs (n = 40) were divided into four treatment groups (10 replications each; M = Maize; OO = Oil Only, no antioxidants; OS = Oil and Synthetic antioxidant; and ON = Oil and Natural antioxidant) and fed supplemented diets for 52 days. The lambs were slaughtered and classed according to the South African Carcass classification system. The *M. longissimus thoracis et lumborum* (LTL) muscles were removed for descriptive sensory analysis (DSA). The training of the panellists (n = 10) was done using a combination of the ballot and consensus methods [4]. The samples were scored using an unstructured 0-100 point line scale. The subcutaneous fat was evaluated for nine aroma attributes (Table 1). The lamb meat was evaluated for various aroma and palate (flavour and taste) attributes, but the results are not included in this paper. The meat texture was described by five attributes: sustained juiciness, tenderness, mealiness, residue and fatty mouth coating. The sensory analysis was conducted over five days, testing two repetitions of each treatment per day (two sessions per day; one replication per treatment per session). The samples were prepared by oven-roasting at 163 ± 1°C, until a core temperature of 65 ± 5°C was reached. After 15 min resting the samples were cut into 1 cm^3 cubes, wrapped in foil, and reheated at 70 ± 1°C for 5 min before presenting to the panellists. The panellist was requested to evaluate the subcutaneous fat first, by rating aroma intensities of initial sniffs after opening the foil wrapper. Thereafter rating meat aroma, meat flavour and meat texture. The collected data underwent pre-processing to determine the reliability of the sensory panel, which includes panellist and sample effect. Normality was tested by the Shapiro-Wilk test at significance level of $P \leq 0.05$, which was used to determine removable outliers from the data. Outliers were removed when the standard residual for the observation deviated with more than three standard deviations from the model value. Pre-processed data from the descriptive sensory analysis and the physical analysis was then evaluated by means of analysis of variance (ANOVA), of a completely random experimental design. Fisher's LSD was calculated at the 5% level to compare treatment means for significant effects. A probability level of 5%

was considered significant. Univariate analyses were performed using SAS software (Version 9.4, SAS Institute Inc, Cary, USA).

III. RESULTS

Across the four treatments no differences were found among any of the subcutaneous fat aroma, nor the cooked meat aroma, flavour, taste, or texture attributes. This is in accordance with results found by other studies investigating oil supplementation in lamb diets [2-5].
A positive correlation existed between the sustained juiciness and tenderness attributes (r=0.868, P<0.0001), whereas a negative correlation existed between tenderness and residue (r=-0.823, P<0.0001).

Table 1. Mean values of the cooked meat aroma attributes for each treatment. Given with the SEM (standard error of mean and the corresponding P-value.

Attribute	M	OO	OS	ON	SEM	P-value
Lamb meat	49.0	48.7	48.4	48.7	0.050	0.992
Lamb fat	24.2	24.3	24.3	23.9	0.051	0.993
Sweet-associated	22.5	22.0	22.1	22.3	0.050	0.999
Liver-like	9.88	10.0	10.0	9.49	0.051	0.997
Metallic	23.2	23.0	22.8	22.9	0.052	0.996
Sheep wool	8.00	7.39	8.00	8.07	0.051	0.994
Barnyard	1.99	1.85	1.89	2.06	0.052	0.980
Sour	2.13	2.13	2.29	2.43	0.052	0.939
Animal Feed-like	4.55	4.44	4.03	4.99	0.050	0.993

Table 2. Mean values of the texture attributes of cooked meat for each treatment. Given with the standard error of the mean and corresponding P-value.

Attribute	M	OO	OS	ON	SEM	P-value
Sustained juiciness[1]	71.9	71.7	72.4	71.9	0.051	0.993
Tenderness[1]	75.3	76.5	76.7	76.8	0.051	0.992
Residue[2]	8.13	6.32	5.92	6.50	0.051	0.998
Mealiness[3]	16.8	17.8	17.6	17.8	0.051	0.998
Fatty mouth coating[4]	20.9	21.0	20.9	20.8	0.051	0.996

[1]Sustained juiciness and Tenderness – impression of juiciness and tenderness on 0 – 100 scale (0 = extremely dry/tough and 100 = extremely juicy/tender), after five chews with molar teeth. [2]Residue – impression of sample residue retained after the first fifteen chews with molar teeth on a 100-point scale (0 = high fibre retention and 100 = complete disintegration of muscle fibres). [3]Mealiness – retained muscle fibres after ten chews using molar teeth. [4]Fatty mouth coating – intensity of fat coating on palate after swallowing.

IV. CONCLUSION

Supplementing feedlot lamb diets with a soybean-sunflower oil blend did not affect the sensory attributes of cooked lamb fat and meat. In addition, the inclusion of antioxidants did not affect any of the sensory attributes. Supplementing feedlot lamb diets with soybean-sunflower oil blend, with or without antioxidants, to increase the energy density of the diet will not affect the sensory quality of lamb meat.

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