PHYSICOCHEMICAL, FATTY ACID COMPOSITION AND LIPID OXIDATION OF WARTHOG CABANOSSI WITH DIFFERENT LEVELS OF PORK FAT CONTENT

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I. INTRODUCTION

The common warthog (*Phacochoerus africanus*) is a wild monogastric ungulate that has a wide distribution across Africa and is a known agricultural pest in South Africa [1]. This species is commonly hunted by trophy hunters and culled by farmers for damage reprisal and the meat has potential to be utilized for human consumption [2] as fresh or processed meat products. Warthog meat is lean (<3% fat) with a healthy fatty acid profile (including n-3 fatty acids) which may be beneficial in producing low fat meat products that appeal to modern consumers, since high fat products may be associated with increased risk of cardiovascular diseases and some cancers in humans. To improve product quality, pork fat is usually used during manufacture because of its excellent qualities (technological and most unsaturated animal fat) and availability. This study investigated the inclusion of different fat levels in a product made with warthog meat.

II. MATERIALS AND METHODS

Warthog meat was sourced from a game farm in KwaZulu Natal, South Africa and pork backfat from a local abattoir in Cape Town, and stored at -20 °C. Meat and fat were thawed at ±4 °C for 12 hours and cut into 5 x 5 cm cubes to produce eight replicates of cabanossi for each treatment (10%, 20% and 30% pork backfat). Three kilogram batches for each replicate were prepared with spice mixture (2% salt, 0.24% curing agent [Prague powder #1], 0.2% coarse black pepper, 0.06% fine nutmeg, 0.1% caraway seeds and 0.2% mustard powder), ground through a 5 mm grinding plate and stuffed into 22 mm diameter sheep casings. The cabanossi were hung in a smoking chamber where temperature and humidity were controlled automatically where smoking was done using oak wood. Weight loss, physiochemical properties [3], fatty acid profile and lipid oxidation analysis were determined using approved methods [4]. Descriptive sensory and consumer acceptance analyses were also done. All data were analysed using GLM procedures.

III. RESULTS AND DISCUSSION

Weight loss declined ($P \leq 0.05$) with increasing levels of fat. Whilst moisture content for 10% and 20% fat cabanossi was similar ($P > 0.05$) (Table 1), it was higher than that of 30% fat but all treatments recorded moisture contents below the suggested upper limit (60%) for good quality cabanossi. As a result of moisture loss, protein, fat, ash and salt contents increased ($P \leq 0.01$) across all treatments after smoking and drying. More protein, less fat and slightly higher salt content were recorded for lower fat cabanossi making it nutritionally superior to the other two treatments. South African legislation recommends fat and salt contents below 30% and 950 mg/100g (3.75%), respectively and all cabanossi complied with these recommendations. Water activity (a_w) and pH decline are important hurdles in ensuring product stability and shelf life by making the environment difficult for survival of spoilage pathogens. There were no differences reported for a_w between cabanossi treatments but pH declined with increasing fat levels. Both a_w and pH fell within the acceptable ranges for reduced pathogen growth. The most abundant fatty acids in all treatments were palmitic and stearic acids (data not shown). There were no differences amongst the treatments for the PUFA:SFA ratio, n-6 fatty acids and atherogenic index (Table 1). However, there were more n-3 fatty acids in the 10% fat cabanossi

which declined with increasing fat, with the n-6:n-3 ratio and thrombogenic index better in the 10% fat cabanossi thus rendering it healthier compared to 20% and 30% cabanossi. There were no differences in TBAR content between cabanossi treatments. However, this result could have been different if a shelf life study was done. Results for descriptive sensory and consumer analysis showed that 10% fat cabanossi was more preferred to the other treatments and preference declined with increasing fat.

Table 1 Means and standard errors for physicochemical attributes, fatty acids and health indices of cabanossi before and after drying

	Raw batter			Cabanossi product		
TREATMENT	**10%**	**20%**	**30%**	**10%**	**20%**	**30%**
Weight (kg)	2.74 ± 0.19	2.74 ± 0.17	2.65 ± 0.12	1.59^{b} ± 0.14	1.77^{ab} ± 0.27	1.91^{a} ± 0.20
Weight loss (%)	-	-	-	42.1^{a} ± 4.39	35.4^{b} ± 6.87	28.0^{c} ± 7.95
a_w	-	-	-	0.93 ± 0.01	0.94 ± 0.01	0.94 ± 0.01
pH	5.48 ± 0.15	5.51 ± 0.13	5.50 ± 0.16	5.17^{a} ± 0.09	5.12^{ab} ± 0.09	5.08^{b} ± 0.07
Moisture (%)	67.3^{a} ± 0.95	63.1^{b} ± 1.36	58.2^{c} ± 0.78	46.2^{a} ± 1.98	45.6^{a} ± 1.81	43.0^{b} ± 3.16
Protein (%)	21.4 ± 4.34	21.5 ± 6.66	18.4 ± 8.15	33.4^{a} ± 2.45	27.2^{b} ± 3.37	27.0^{b} ± 3.70
Fat (%)	10.3^{b} ± 3.88	16.0^{b} ± 3.99	22.9^{a} ± 5.43	15.7^{c} ± 4.13	23.2^{b} ± 5.02	28.8^{b} ± 4.09
Ash (%)	2.8^{a} ± 0.16	2.8^{a} ± 0.12	2.7^{b} ± 0.11	4.7^{a} ± 0.21	3.9^{b} ± 0.32	3.7^{c} ± 0.20
Salt (%)	1.9 ± 0.09	1.9 ± 0.15	1.2 ± 0.11	3.0^{a} ± 0.18	2.8^{b} ± 0.18	2.7^{b} ± 0.24
TBARs (mg MDA/kg)	0.19^{b} ± 0.07	0.22^{ab} ± 0.07	0.25^{a} ± 0.06	0.43 ± 0.10	0.40 ± 0.07	0.40 ± 0.11
FATTY ACIDS						
PUFA:SFA	1.02^{a} ± 1.07	0.58^{b} ± 0.18	0.63^{b} ± 0.16	0.73 ± 0.15	0.75 ± 0.10	0.68 ± 0.11
Total n-6 (%)	28.19 ± 5.51	23.01 ± 4.41	23.86 ± 3.43	24.99 ± 3.08	26.34 ± 1.87	25.43 ± 2.01
Total n-3 (%)	3.68^{a} ± 1.34	3.40^{ab} ± 1.11	2.71^{b} ± 0.72	4.61^{a} ± 1.03	3.91^{a} ± 0.89	2.97^{b} ± 0.55
n-6:n-3	9.27 ± 8.81	7.40 ± 2.76	9.13 ± 1.83	5.69^{a} ± 1.49	7.17^{b} ± 2.20	8.79^{c} ± 1.68
HEALTH INDICES						
Atherogenic index	0.39 ± 0.13	0.44 ± 0.06	0.43 ± 0.05	0.40 ± 0.04	0.40 ± 0.03	0.42 ± 0.02
Thrombogenic index	0.94 ± 0.68	1.02 ± 0.25	0.96 ± 0.29	0.81^{b} ± 0.13	0.82^{b} ± 0.10	0.88^{a} ± 0.14

^{abc}Means with different superscripts within rows differ significantly (P ≤0.05) for raw batter and finished cabanossi product, respectively.

IV. CONCLUSION

The results showed that warthog meat can be used to produce a low fat meat product. However, from a health and nutritional point of view, it is recommended that warthog cabanossi be produced using lower fat. This was confirmed by the fact that consumers preferred lower fat cabanossi compared to higher fat. This study was limited to changes during the production phase, it would be interesting to investigate the influence of different fat levels on product shelf life of warthog cabanossi.

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REFERENCES

1. Somers, M. J., & Penzhorn, B. L. (1992). Reproduction in a reintroduced warthog population in the Eastern Cape Province. South African Journal of Wildlife Research 22: 57-57.
2. Swanepoel, M., Leslie, A. J. & Hoffman, L. C. (2016). Comparative analyses of the chemical and sensory parameters and consumer preference of a semi-dried smoked meat product (cabanossi) produced with warthog (*Phacochoerus africanus*) and domestic pork meat. Meat Science 114: 103-113.
3. Folch, J., Lees, M. & Stanley, S. G. H. (1957). A simple method for the isolation and purification of total lipids from animal tissues. Journal of Biological Chemistry 226: 497-509.
4. AOAC. (2005). Official methods of analysis (19th ed.). Washington, DC, USA: Association of Official Analytical Chemists.