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Profile of cabanossi made with exotic meats and olive oil

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ABSTRACT

The effect of olive oil inclusion on the chemical and sensory characteristics in cabanossi made with ostrich and warthog meat was investigated. Ostrich meat from soybean oilcake (SBOC) and cottonseed oilcake dietary inclusion levels (CSOC), and olive oil were included at three levels (0%, 1% and 2%) resulting in six treatments. The fat content in the cabanossi increased with increasing levels of oil inclusion but were all < 10%, which allows it to be classified as a low fat meat product. Total monounsaturated fatty acids in the cabanossi increased whilst total saturated fatty acids and total polyunsaturated fatty acids decreased as olive oil increased. The SBOC cabanossi had a lower fat and higher crude protein content. The inclusion of olive oil at 2% resulted in a cabanossi with increased tenderness, juiciness and cured red meat colour, all factors that appeal to the consumer, while the overall flavour descriptors were not adversely affected by the inclusion of olive oil.

1. Introduction

Over the last decade, consumer preferences have changed drastically with an emphasis on nutrition and health, specifically with regards to saturated fat and cholesterol content of meat products (Resurreccion, 2004). In most developed countries obesity and cardiovascular disease have become a topic of grave concern (Williams, 2000) and it has been proposed that intake of total fat and saturated fatty acids (SFA) should decrease to < 10% of dietary energy (World Health Organization, 2003). This resulted in the promotion of consuming or changing the diet composition to increased polyunsaturated fatty acids (PUFA) content, specifically the long chain omega-3 PUFA eicosapentaenoic acid (C20:5n-3; EPA) and docosahexaenoic acid (C22:6n-3; DHA) for their beneficial physiological responses. The presence of these PUFA in the typical western diet is very low due to the small amount of fish and fish oils consumed. Williams (2000) explained that even if it is possible to achieve favourable levels of these n-3 PUFA by consuming fish and fish oils, the general consumer perceive these types of products as unpalatable.

Apart from increasing the total PUFA fat content of processed meat products, an increased intake of total monounsaturated fatty acid (MUFA) content has also been associated with a decrease in coronary heart disease (Bloukas & Paneras, 1993), as well as having a protective effect against low density lipoproteins (LDL) oxidation and oxidative stress in humans (Bolger, Bruton, Lyng, & Monahan, 2017). Therefore, in order to increase the MUFA content it has been suggested to replace animal fat with certain vegetable oils, which would also reduce the total cholesterol content (Hygreeva, Pandey, & Radhakrishna, 2014; Rodríguez-Carpena, Morcuende, & Estévez, 2012). In addition, MUFA are more stable than PUFA regarding lipid oxidation and might therefore improve the overall shelf life of these processed products.

Pork fat and specifically "hard/firm" back fat that has a high content of SFA and cholesterol is generally used as an ingredient in processed meat products (Muguerza, Ansorena, Bloukas, & Astiasarán, 2003). A variety of value added meat products have already been manufactured with olive oil as a replacement or partial replacement for animal fat, which has proven to be very successful with regards to nutritional value as well as sensory quality (Ansorena & Astiasarán, 2004; Bloukas & Paneras, 1993; Pappa, Bloukas, & Arvanitoyannis, 2000; Rodríguez-Carpena et al., 2012). Rodríguez -Carpena et al. (2012) used avocado, sunflower and olive oil as a replacement for pork backfat in the production of hamburger patties and found the most favourable vegetable oils were avocado and olive oil. Olive oil has positive effects with regards to nutritional value and oxidative stability as well as demonstrating protection against several cancer types (Escrich, Moral, Grau, Costa, & Solanas, 2007; Hygreeva et al., 2014). It is one of the most monounsaturated vegetable oils containing 56.3 to 86.5% MUFA, 8 to 25% SFA and 3.6 to 21.5% PUFA (Bloukas & Paneras, 1993).

Among exotic meats, ostrich and warthog meat is classified as a

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healthy source of protein due to its leanness and desirable fatty acid profile (Sales, 1998; Swanepoel, Leslie, & Hoffman, 2016; Swanepoel, Leslie, Van der Rijst, & Hoffman, 2016). Another characteristic of ostrich meat is its high ultimate pH (pH_u) which is favourable in processed meat products as it increases the water holding capacity (WHC) (Fisher, Hoffman, & Mellett, 2000) but comes as a disadvantage in terms of shelf life, flavour and its ability to absorb curing agents (Sales & Mellett, 1996). Several value-added ostrich products have already been manufactured but these are mainly based on established technologies and are generally just applied as is to ostrich meat (Fisher et al., 2000). Warthog meat on the other hand has an improved (lower) pH_u ranging around 5.43–5.66, and has successfully been used to produce processed meat products such as back bacon (Swanepoel, 2015) and cabanossi (Swanepoel, Leslie, & Hoffman, 2016).

While warthog meat is harvested from wild populations, ostrich meat is produced by ostriches farmed under intensive or semi-intensive conditions where most of their nutrition is provided through formulated feeds and supplements. While soybean oil cake is typically added as a source of protein to ostrich feeds globally, it is considered expensive by producers who has therefore become interested in alternative, lower cost plant-based protein sources. Cottonseed oil cake has been investigated as such a protein source through partial replacement of the soybean oil cake component by cottonseed oil cake (Dalle Zotte et al., 2013). While studies have shown that this is feasible in terms of animal production, it has not been established whether it might affect the chemical and sensory profile of processed meat products.

Cabanossi, which originated in Poland, is a semi-dry, cured sausage that is smoked and slightly spiced. Generally it consists of pork meat and pork fat (also known as speck in South Africa) but can be produced using a variety of meats such as duck, turkey, and venison and beef and/or sheep fat. This study investigated the use of olive oil as a replacement for pork fat in cabanossi made with ostrich and warthog meat and its effect on the chemical and sensory profile of the cabanossi.

2. Materials and methods

2.1. Processing

The ostrich meat was obtained from the fan fillet of 54 growing ostriches reared on an experimental diet with cottonseed oilcake (CSOC) meal replacing the standard soya bean oilcake (SBOC) diet (Dalle Zotte et al., 2013). The treatment groups of birds were subdivided into three replicate pens containing nine birds each (approx. 200 m^2/bird). One group received a 10% soybean oilcake (SBOC) meal inclusion based diet with zero CSOC meal while the other group received a diet with 9% CSOC as a full replacement of the SBOC meal. The meat used for cabanossi was based on the effects that the inclusion of SBOC and CSOC had on their MUFA (higher in SBOC) and PUFA (higher in CSOC) fatty acid contents.

The slaughtering of ostriches took place at commercial abattoir in Swellendam, South Africa. After electrical head stunning (90–110 V, 400–600 mA, 4–6 s), the ostriches were suspended by both legs and exsanguinated by a neck cut to the aortic vein followed by a thoracic stick. Bleeding was followed by plucking, skinning, evisceration and a health inspection. Carcasses were chilled for 24 h at 0–4 °C after which the fan fillet (*Iliofibularis* muscle) was excised, vacuum packed and frozen at −20 °C at Stellenbosch University.

A total number of 58 warthogs were shot using single shot bolt action rifles near Kimberley, South Africa (Swanepoel, Leslie, Van der Rijst, & Hoffman, 2016). The animals were exsanguinated by thoracic sticking immediately after shooting, transported to a slaughter facility, weighed and dressed. All the muscles, except for the *Longissimus lumborum* (LL) (consisting of *thoracic* muscle located at vertebrae 12 to 13 [T_{12}/T_{13}] up to the *longissimus* muscle located at vertebrae 5 [L_5]), *Biceps femoris, Semimembranosus, Semitendinosus, Infraspinatus* and *Supraspinatus*, were used for the cabanossi. The muscles were vacuum packed, frozen at −4 °C, transported to Stellenbosch University and stored at −20 °C.

Six cabanossi treatments (two ostrich dietary treatments [SBOC and CSOC] x three inclusion levels of olive oil [0%, 1% and 2%]) were under investigation: SBOC 0% olive oil (SBOC0%), SBOC 1% olive oil (SBOC1%), SBOC 2% olive oil (SBOC2%), CSOC 0% olive oil (CSOC0%), CSOC 1% olive oil (CSOC1%) and CSOC 2% olive oil (CSOC2%). A single batch of cold-pressed extra-virgin olive oil (Frantoio cultivar) from Tokara Olive Farm (Stellenbosch, South Africa) was used. All the remaining ingredients were provided by Deli Spices (25 Bertie Avenue, Epping 2, Cape Town, South Africa). From the SBOC group, 30 fan fillets were used, and for the CSOC treatment group, 31 fan fillets were used. Each experimental treatment consisted of six independently compiled batches.

The cabanossi recipe for each batch (5 kg) contained 50% of ostrich meat and 50% of warthog meat with one cabanossi spice pack (200 g) from Deli Spice (product code 02266006; 25 Bertie Avenue, Epping 2, Cape Town; https://delispices.co.za/product/deli-cabanossi-stix-ready-pack/).The spice pack consisted of one 100 g spice pack and a second 100 g curing salt pack containing phosphate, ascorbic acid, monosodium glutamate (MSG) and colourant (C.I. 45,430-E127 = 0.002% Erythrosine). The curing salt pack contained 0.6% sodium nitrite and 0.3% sodium nitrate. For the 1% olive oil inclusion, 50 ml was added to a 5 kg batch and for the 2% olive oil, 100 ml was added to a 5 kg batch.

The ostrich and warthog meat was defrosted at 4 °C for 12 h before being minced through a 12 mm diameter disc and mixed together. The cabanossi spice was then added and mixed by hand. The meat and spice mixture was then minced through a 5 mm diameter disc to ensure adequate mixing of the ingredients. Finally the olive oil was added to the mixture. The cabanossi mixture was placed in a hand sausage filler and filled into natural sheep casings (18–22 mm) to make sausages weighing ~20 g each.

The cabanossi were placed into a Reich Airmaster® UKF SmartSmoker 2000 BE (Reich Klima-Räuchertechnik, Urbach, Germany) with a TradiSmoker LS 500 HP electronic that was controlled automatically by a Microprocessor (Unicontrol 2000). The program settings are depicted in Table 1. The cabanossi were removed after processing and six randomly selected sausages were taken from each cabanossi batch, and pooled for further analyses. This gave 36 samples (6 treatments with 6 replicates/batches per treatment) for further analyses.

2.2. Proximate analysis

The randomly selected cabanossi samples of the six treatments were homogenised and analysed for total percentage of moisture, crude protein, fat, and ash content.

Proximate analysis of the cabanossi samples were analysed according to the Association of Official Analytical Chemist's Standard Techniques (AOAC), including AOAC 934.01 (AOAC International, 2002a), AOAC 942.05 (AOAC International, 2002b) and AOAC 992.15 (AOAC International, 2002c) using a Leco Nitrogen/Protein Analyser

Table 1
Production program for the cabanossi made in a Reich Airmaster® UKF SmartSmoker 2000 BE.

Activity	Temperature (°C)	Relative humidity (%)	Time (hrs)
Reddening	40	80	2.00
Drying	30	30	2.00
Cold smoking	30	20	0.30
Smoke destruction	30	30	0.10
Drying	30	30	2.00
Cold smoking	30	20	0.20
Smoke destruction	30	20	0.10
Drying	30	30	8.00

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