Effect of Replacing Beef Fat with Poppy Seed Oil on Quality of Turkish Sucuk

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Abstract

Sucuk is the most popular dry-fermented meat product. Sucuk has a relatively high fat. Poppy seed oil as animal fat replacer was used in Turkish sucuk and effects of its use on sucuk quality were investigated. There was a significant $(p<0.5)$ treatment $\times$ ripening time interaction for moisture, pH $(p<0.05)$ and 2-thiobarbituric acid reactive substances (TBARS) values $(p<0.01)$. Increasing poppy seed oil level decreased $(p<0.05)$ TBARS values. Addition of poppy seed oil to the sucuks had a significant effect $(p<0.01)$ on hardness, cohesiveness, gumminess, chewiness and springiness values. Cholesterol content of sucuks decreased $(p<0.05)$ with poppy seed oil addition. Using pre-emulsified poppy seed oil as partial fat replacer in Turkish sucuk decreased cholesterol and saturated fatty acid content, but increased polyunsaturated fatty acids. Poppy seed oil as partial animal fat replacer in Turkish sucuk may have significant health benefits.

Key words: poppy seed oil, turkish sucuk, fat replacer, cholesterol reduction, polyunsaturated fatty acids

Introduction

Sucuk is the most popular dry-fermented meat product produced in Turkey. It can be produced from beef and water buffalo meat and it may contain beef fat, sheep tail fat, salt, sugar, nitrite, nitrate and/or nitrite/nitrate and various spices (Gökalp et al., 1999). Sucuk has relatively high fat content ranging from 30 to 40% and fat is easily recognizable in its slices (Yıldız-Türp and Serdaroğlu, 2008). Fat is a major contributor of flavor, texture, mouth feel, juiciness and overall acceptability of the meat products (Muguerza et al., 2002). However, unfortunately, high amount of fat in meat products is associated with high amount of saturated fatty acids and cholesterol in meat products. Therefore, meat products are blamed for causing hypertension, obesity, cardiovascular diseases and coronary health diseases (Özvural and Vural, 2008). Moreover, high-fat intake also increases risk of some cancers, namely colon, breast and prostate (Chizzolini et al., 1999). To this end, health organizations all over the world highly recommend limiting the intake of saturated fatty acids and cholesterol (NCEP, 1988).

The demand for healthy meat products has recently increased considerably and the food industry has been trying to develop or modify meat products by decreasing amount of animal fat (Choi et al., 2010; Gök et al., 2011; Yıldız-Türp and Serdaroğlu, 2008). Several studies have focused on reducing the fat and cholesterol content of meat products (İlkkkan et al., 2009; Kayaardı and Gök, 2004).

Oilseeds are major source of fat, protein, and carbohydrate and they have potential to be used in nutraceuticals and functional foods (Bozan and Temelli, 2008). Papaver somniferum (poppy) seeds are very popular in Europe and Turkey and are extensively used in bakery products (Erinc et al., 2009). Poppy seed oil (PSO) contains 73% linoleic, 10% palmitic, and 13% oleic acid as major fatty acids (Gök et al., 2011; Nergiz and Otles, 1994). The rich polyunsaturated fatty acid content of poppy seed oil makes it a viable alternative to be used in reduced fat meat products. Therefore, the goals of this study were to produce Turkish sucuk using poppy seed oil as partial animal fat replacer and to determine chemical, textural, color and sensory properties of the product.

Materials and Method

Sucuk formulation and preparation

Meat used in the study came from 3-year old mature
cows and beef fat was obtained from Portakaloğulları Meat Corporation (Afyonkarahisar, Turkey). Poppy seed oil was supplied locally (Arpacılı Haşhaş Ezmeçilik Company, Turkey) and other ingredients were also purchased locally. The lean meat was separated from visible fat, tendons and other connective tissues. The lean meat and frozen beef fat were minced in a cutter (Germany) to a particle size of about 3 mm and subsequently mixed in a mixer. Sucuk formulation contained 9 kg meat (10% fat, wet basis), 1.1 kg beef fat, 0.20 kg NaCl, 0.16 kg garlic, 0.04 kg sucrose, 0.07 kg hot red pepper, 0.04 kg sweet red pepper, 0.08 kg black pepper, 0.080 kg cumin, 0.02 kg allspice, 300 ppm NaNO₂ and 150 ppm NaNO₃ and 0.002 g starter culture (Lactobacillus plantarum and Staphylococcus carnosus, Bactoferm TM T-D-66, CHR HANSEN, Germany).

The fat content of the first batch (control) was adjusted to 20% by adding beef fat. Poppy seed oil was added to the next three treatments of sucuk dough as pre-emulsified fat (PEF) with sodium caseinate (American Casein Company, USA), by replacing 25, 50 and 75% of beef fat, respectively. To produce the poppy seed oil emulsion, 1 part of sodium caseinate and 8 parts of hot water (75 °C) were mixed for 2 min in a blender. The mixture was emulsified with 10 parts of poppy seed oil for 3 min. The resultant mixture and frozen fat were ground through 12-mm plate (Esmak Machine Co, Turkey). Sucuk dough coming from the grinding machine was refrigerated at 4°C for 8 h and was thoroughly mixed in a bowl cutter (Germany) at 10-12 rpm for 2 min. The mixture was stuffed into the natural cow intestine casings of 38-40 mm in diameter. Sucuk samples were held in a tempering room (10-12°C and 70-75% relative humidity) for 12 h. Then, they were ripened in an incubation room (Germany) for 12 d with the following protocol: 2 d at 90% relative humidity (RH) and 28°C; 2 d at 85% RH and 24°C; 2 d at 80% RH and 22°C; 2 d at 75% RH and 20°C; 2 d at 70% RH and 18°C; 2 d at 65% RH and 18°C.

Proximate analysis
Moisture, fat (ether-extractable) and pH value were determined according to AOAC (1990) procedures on the day 0 (initial), 4, 7 and 12 of ripening. The number of replications was three for all the properties measured.

Lipid oxidation analysis
The 2-thiobarbituric acid reactive substances (TBARS) test was used to assess extent of lipid oxidation throughout ripening. The TBARS test was performed as described by Gök et al. (2008).

Texture profile analysis
For texture profile analysis (TPA), sucuk samples having diameter of 38 mm were cut into cylinders with height of 20 mm, and wrapped with plastic, and held at room temperature for equilibration and were then compressed twice with 50% deformation with a stainless compression probe (Bozkurt and Bayram, 2006). TPA tests were performed using a Texture Analyzer (TA-XT plus, Stable Micro Systems Ltd., UK).

The stainless compression probe of 5 cm in diameter, mounted to a 50 kg load cell, was used for texture analyses at a crosshead speeds of 1 mm/s (pretest), 5 mm/s (test), and 5 mm/s (post test); time between two compressions, 5.0 s; trigger type, auto-20 g; and data acquisition rate, 200 point/s. The TPA parameters were obtained from force-time curves as described by Bourne (1978): Hardness (resistance at maximum compression of first bite to deform the sample; peak force of the first compression cycle in N), cohesiveness (extent to which sample could be deformed prior to rupture; positive force ratio of the second compression area to the first compression area (A₂/A₁), Gumminess (force necessary to disintegrate a semi-solid sample for swallowing, it is the multiplication of hardness and cohesiveness, N), springiness (a measure of how well a product physically springs back after it has been deformed during first compression, ability of sample to recover to its original height after the deforming force was removed, mm), chewiness (the energy need to chew a solid sample to a steady state of swallowing hardness multiplied by cohesiveness multiplied by springiness in, Nmm)

Color measurement
Color measurements (CIE L*, a*, b*) were taken with a colorimeter (Minolta CR 400, Japan). The samples were placed into petri dishes before taking the readings; no gap existed between the sample and the petri dish lid during measurement. The lens of the colorimeter was placed against the petri dish lid, and six readings were averaged.

Cholesterol content
Total cholesterol content of sucuks was determined as given by Naeemi et al. (1995). Briefly, 1 g of sucuk sample was hydrolyzed with 5 mL saturated methanolic KOH and then, 5 mL of cyclohexane was added and the mix-