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The effect of replacing beef fat with olive oil and production methods on oxidative changes in fermented sausage (Sucuk) (#199)

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Introduction

Sucuk is a dry fermented sausage produced in Turkey with beef and beef fat with the addition of red pepper, black pepper, cumin and garlic. Sucuk also is a meat product which is more prone to lipid oxidation [1] due to its high fat content [2] during the ripening and storage period. The progress of lipid oxidation in processed meat products depends on many factors such as processing methods, storage conditions, oxygen availability depend on packaging, oil type used in production and additives [3, 4].

Oxidation of proteins also causes changes in quality of meat, involves the loss of essential amino acids and decreases protein digestibility which affects its nutritional value. α-*aminoadipic (AA*S) and γ-*glutamic semialdehydes (GGS)* are considered the main carbonyl products of oxidized proteins and play up as protein oxidation biomarkers in biological systems. objective of this study was to investigate the effect of replacing beef fat with olive oil and production methods (fermented and heat treated) on lipid oxidation (peroxide value) and protein oxidation (carbonyl content, AAS, GGS) in sucuk (Turkish sausage).

Methods

Four different formulations of sausages, containing 4 kg meat each, were prepared. Each treatment was formulated to contain 20% total fat. Control (C) group was consisted of 100 % beef fat. Olive oil was replaced with beef fat at levels of 15% (O15), 30 % (O30) or 45% (O45). After mixing all ingredients, sausage doughs were stuffed into natural casings. After the stuffing samples were divided into 2 groups (F and T). Sausages of the F (fermented) group were subjected to fermentation and ripening under the following conditions; 22.5°C, 60% RH, 3 h; 23°C, 88% RH until achieving the pH of 5.4; 21°C, 83% RH 3 days; 19°C, 73% RH until achieving the moisture content of 40%. After the first stage of fermentation process (22.5°C, 60% RH, 3 h; 23°C, 88% RH until achieving the pH of 5.6), sausages of H group (heat treated) were subjected heat treatment in oven (Afos, England) until the core temperature reached 68°C and after the heating process sausages were cooled by spraying water and then allowed to stand at 19°C and 73% RH for 2 days to drop the moisture up to 50%.

Peroxide value (PV) was determined by titration method of Ockermann [5]. The total carbonyl content sucuks was analyzed by the method of Liu et al. [6]. AAS and GGS contents were analyzed using the method described by Utrera and Estévez [7].

The data was analyzed by one-way ANOVA using SPSS software (SPSS 21.0, USA). Duncan's multiple range test was performed to identify significant differences ($P<0.05$) between formulations. Differences between production methods were analyzed with Paired-Samples T Test by using SPSS. The average values were reported along with standard deviation.

Results

Peroxide values and carbonyl contents of samples are shown in Figure 1 and 2, respectively. Peroxide values and carbonyl contents of heat treated sausages were significantly higher compared to fermented groups. The increase in peroxide content is probably the result of the heat applied during production. Carbonyl contents, one of the indexes of total protein oxidation, were also increased with heat treatment. The addition of olive oil caused significant changes in peroxide values and carbonyl contents of the samples ($P<0.05$). Since olive oil contains high amount of unsaturated fatty acids, it's more prone to oxidative changes. For this reason, O45 samples had the highest values compared to C samples ($P<0.05$). Geçgel et al. [9] reported that incorporation of vegetable oils to the formulation of fermented sausages caused increments in peroxide values.

AAS and GGS values of sucuk samples were given in Table 1. Although AAS was initially detected, GSS was not detected in the fermented sucuks. However, the formation of GGS was observed in the heat treated sucuk samples. AAS contents of heat treated sucuks were also higher than AAS contents of fermented sucuks ($P<0.05$). As seen with other oxidation products, the amount of AAS and GGS were influenced from the heat treatment during production. On the other hand, using olive oil as a fat replacer decreased the AAS and GGS contents of heat treated sucuks. This situation can be explained with the presence of antioxidants in olive oil.

Conclusion

The results of our study showed that fatty acid composition and production method of sucuk have an effect lipid oxidation and protein oxidation and on the formation of specific protein oxidation markers in terms of α-Aminoadipic semialdehydes (AAS) and γ-glutamic semialdehydes (GGS).

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	AAS		GGS	
Groups	F	H	F	H
C	0,21±0,01	0,54±0,00^{b}	0,00	0,34±0,01^{d}
O15	0,22±0,06	0,57±0,00^{b}	0,00	0,15±0,01^{c}
O30	0,21±0,01	0,44±0,00^{a}	0,00	0,13±0,01^{b}
O45	0,22±0,01	0,42±0,00^{a}	0,00	0,11±0,01^{a}

Table 1.
α-aminoadipic semialdehyde (AAS) and γ-glutamic semialdehyde (GGS) contents of sausages

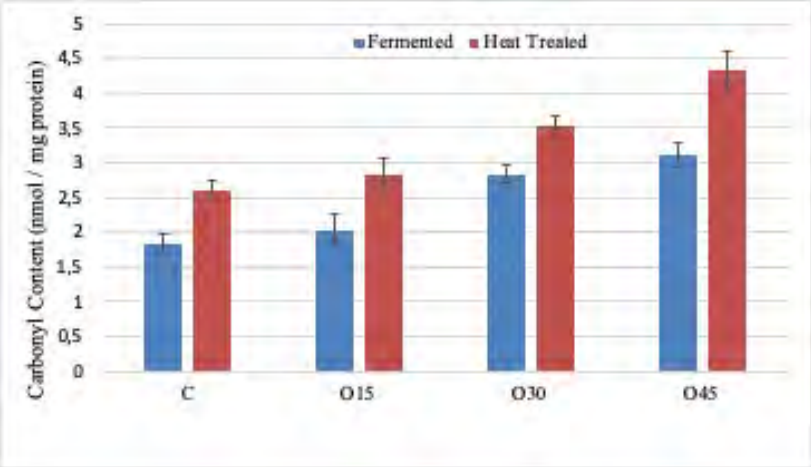

Figure 2. Carbonyl content of sucuk samples

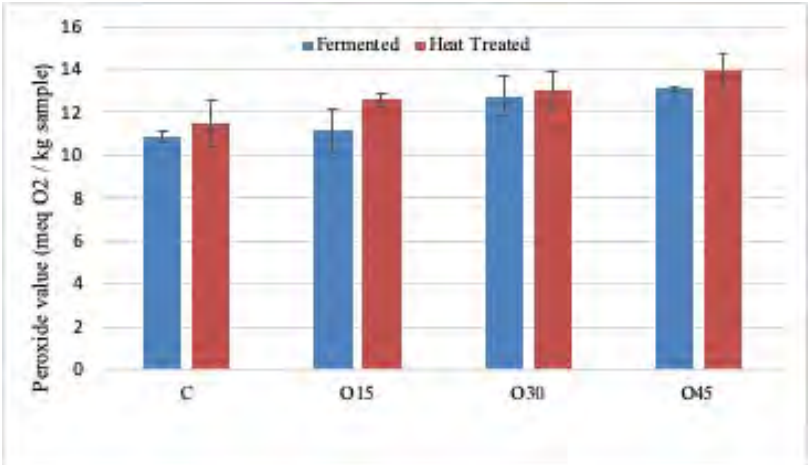

Figure 1. Peroxide value of sucuk samples

Notes