Fatty acid composition and cholesterol content of Turkish fermented sausage (sucuk) made with corn oil

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Abstract

The objective of this study was to investigate the effects of replacing beef fat with corn oil on fatty acid composition and cholesterol content of sucuk. Sucuks were produced by replacing 15% (C15), 30% (C30) and 50% (C50) of beef fat with corn oil incorporated as pre-emulsified with simplesse®100 (whey protein powder). All corn oil added samples had higher moisture content than the control samples. C30 and C50 samples had significantly lower cholesterol content than C15 and control samples. Replacement of beef fat with corn oil increased PUFA fraction significantly. The ratio of MUFA+PUFA/SFA level was 0.80% in control samples and 1.5% in C50 samples.

Introduction

Sucuk is one of the most popular traditional meat product in Turkey. It is mostly produced from beef, beef backfat, tail fat, salt, sugar, garlic, nitrite and/or nitrate and various spices (Gökalp et al., 1994). Sucuk contains a high fat content (30–40%). Fat plays an important technological role during sucuk processing. It helps loosen the mixture, which facilitates continuous moisture release from the inner parts of the product Beef or lamb fat that used for sucuk production are rich in saturated fatty acids and cholesterol (Kayaardı & Gök, 2003).

Various vegetable oils have been incorporated in cooked and uncooked meat products. The effect of replacement by olive oil (Bloukas and Paneras, 1993; Bloukas et al., 1997; Kayaardı and Gök, 2003;Muguerza et al.,2001; Muguerza et al., 2002; Pappa et al.,2000), soy oil (Muguerza et al., 2003), interesterified palm and cottonseed oils (Vural, 2003) on the color, chemical and sensory properties of fermented meat products have been extensively investigated. In these studies, generally soy protein isolate is used for the pre-emulsification of the vegetable oils. The objective of this study was to investigate the effects of replacing beef fat with corn oil incorporated as pre-emulsified with simplesse®100 (whey protein powder) on fatty acid composition and cholesterol content of sucuk.

Materials and methods

Fresh boneless beef cuts and beef backfat were obtained from a local manufacturer in İzmir. Corn oil was used as pre-emulsified, 1 part of simplesse®100 (CP Kelco,whey protein powder), were mixed with 2 parts of corn oil Four different formulation of sucuk were prepared. Each treatment was formulated to contain 20% total fat. Beef fat was the only fat material used in the control group. Corn oil was added to the sucuk formulation by replacing 15, 30 and 50% of beef fat, respectively. The following ingredients were added per kg of meat mixture; 27.5 g spice mix, 28 g curing mix, 10 g garlic and 0.5 g lyofilized starter culture mixture (*Staphylococcus xylosus* + *Pediococcus acidilactici*). Saccarose was added to the samples with corn oil at half of the amount in the control samples, because of the possible effect of simplesse®100 on fermentation. The prepared sucuk batters were stuffed into collagen casings and ripened as follows; 21^0C and 88% RH until the pH reached 5.4, then, six hours at 20^0 C ± 1 and 80% RH, 23–24 ^{0}C and 80% RH until the pH reached 5.0 then at 15^0 C ± 1, 70% RH for the rest of the ripening period.

Moisture (AOAC, 1990), fat (Flynn and Bramblett, 1975), protein (Anonymous, 1979) measurements were carried out on sucuk samples after ripening period. Total cholesterol content of sucuks was determined according to Naeemi et al.,(1995).

Lipids were extracted (Flynn & Bramblett, 1975) and methylated (Anon, 1987). Fatty acid methyl esters (FAME) were analyzed using a gas chromotograph (HP 5890) fitted with a fused silica capillary column (CP-Sil-88;50 mxo.25 mm i.d., 0.20 lm film thickness of polyethylene).

Results and discussion

Mean percentages of moisture, protein and fat of the final product are given in Table 1. No differences ($p > 0.05$) were found in fat and protein contents between treatments. Corn oil added samples had higher moisture contents than the controls. It is possible that corn oil have covered the meat particles and prevented

the release of moisture (Bloukas et al., 1997). Also the effect of Simplesse 100 to binding water could be the reason of the high moisture content of samples containing corn oil.

Table 1. Chemical composition of the sucuk samples

	Sucuk		
Sample	**Moisture (%)**	**Fat (%)**	**Protein (%)**
C	36.5[a]	35.5	26.6
C15	37.8[ab]	35.9	26.1
C30	40.7[bc]	35.4	22.6
C50	42.8[c]	34.9	21.8

Means within same column with different letters (a–b) are significantly different ($p < 0.05$).

Table 2 presents the cholesterol content and fatty acid composition of the samples. Cholesterol content decreased progressively as the percentage of corn oil used increased ($p < 0.05$). Similar results were reported by several researchers (Muguerza et al., 2001; Muguerza et al., 2002; Kayaardı ve Gök, 2003; Muguerza et al., 2003 Muguerza et al., 2004).

Table 2. Cholesterol content and fatty acid composition of sucuk samples

Cholesterol (mg/100g)	**SAMPLE**			
	C	**C15**	**C30**	**C50**
	60.3[b]	54.7[b]	35.1[a]	27.8[a]
Fatty Acid Composition (%)				
$C_{10:0}$	-	-	-	_
$C_{12:0}$	0.1	0.1	0.1	-
$C_{14:0}$	1.8[a]	2.5[b]	2.8[b]	1.8[a]
$C_{14:1}$	0.3	0.5	0.5	0.5
$C_{15:0}$	0.4[b]	0.4[c]	0.5[c]	0.3[a]
$C_{16:0}$	26.8	26.9	25.5	21.4
$C_{16:1}$	3.0	2.9	2.2	3.4
$C_{17:0}$	1.3[c]	1.2[bc]	1.0[ab]	0.9[a]
$C_{18:0}$	24.4	20.3	22.0	14.9
$C_{18:1}$	40.9	37.9	34.1	40.4
$C_{18:2}$	0.19[a]	6.9[b]	10.9[c]	15.4[d]
$C_{18:3}$	0.4[ab]	0.3[a]	0.3[a]	0.6[b]
$C_{20:0}$	0.4[b]	0.19[a]	0.2[a]	0.4[b]
Σ SFA	55.2[b]	51.5[b]	52.1[b]	39.6[a]
Σ MUFA	44.2	41.3	36.7	44.4
Σ PUFA	0.6[a]	7.2[b]	11.2[c]	16.0[d]
MUFA+PUFA	44.9[a]	48.5[a]	47.9[a]	60.4[b]
MUFA+PUFA/SFA	0.81[a]	0.94[a]	0.92[a]	1.52[b]

SFA saturated fatty acids, MUFA monosaturated fatty acids, PUFA, Polyunsaturated fatty acids.
Means within same row with different letters (a–b) are significantly different ($p < 0.05$).

Usage of corn oil in sucuk formulation significantly affected the levels of C14:0, C15:0, C17:0,C18:2, C18:3 and $C_{20:0}$ fatty acids. The total amount of linoleic acid ranged from 0.2 to 15.4%.Increament in linoleic acid content was due to to linoleic acids which are abundant in corn oil

($p<0.05$). SFA fraction of C50 samples was found significantly lower than other sample groups ($p<0.05$).Muguerza et al., (2003) determined that SFA was lower in fermented sausages in which pork fat was replaced by 25% soy oil Replacement of beef fat with corn oil increased PUFA fraction significantly ($p<0.05$), because of the significant increament of the $C_{18:2}$ level. So the highest PUFA level was found in C50 sample (16.0%) and the lowest level was found in the C sample (0.63%). The ratio of MUFA+PUFA/SFA level was 0.80% in control samples and 1.5% in C50 samples. PUFAs are also known to reduce plasma cholesterol level, furthermore there are reports of other potential benefits, such as reducing blood pressure and preventing cardiac arrhythmias (Abraham et al., 1989).

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