

THE EFFECT OF DIFFERENT COOKING PROCESS ON MICROBIOLOGICAL QUALITY OF KOKOREC

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Abstract

In this research, totally 180 kokorec samples which 60 raw, 60 grilled and 60 tandir ovened were investigated certain microbiological parameters. Average total mesophilic aerobic bacteria (TMAB), coliform and coagulase (+) *S. aureus* counts were found as 3.8×10^7 , 2.2×10^4 and 3.2×10^3 cfu/g in raw samples, respectively. Also, the results were found to be positive for *E. coli*, *E. coli* 0157:H7, *C. perfringens* and *Salmonella* spp. as 60 (100%), 9 (15%), 18 (45%) and 54 (90%) in raw samples, respectively. On the other hand, it was determined that average TMAB, coliform and coagulase (+) *S. aureus* counts in grilled and tandir ovened samples as 1.2×10^3 , 5.7×10^1 , 1.2×10^2 cfu/g and 2.3×10^4 , 8.6×10^1 , 3.1×10^2 cfu/g. respectively. No *E. coli* 0157:H7 and *C. perfringens* were determined in grilled and tandir ovened kokorec samples, while the results were only found to be positive for *E. coli* and *Salmonella* spp. as 3 (5%) in these samples. Also, it was found to be positive for *E. coli* as 24 (40%) and *Salmonella* spp. as 42 (70%) in tandir ovened kokorec samples.

Keywords: Food Hygiene, Public Health, Offal, Kokorec, Microbiological Quality

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1. INTRODUCTION

Meat is obtained from sheep and cattle farm animals, poultry, seafood and of various game animals of the skeletal muscle and internal organs by slaughter, fragmentation and processing. Offal also parts of a meat animal which is used as food but which are not skeletal muscle and it covers insides including the heart, liver, and lungs, all abdominal organs and extremities, tails, feet, and head including brains and tongue [1]. Although internal organs of slaughter animals contain more water, contains less fat compared to red meat. On the other hand, while red meat contain very little carbohydrate, most of the internal organs provides high carbohydrate rate [2]. While not achieving a strong acceptance by consumer, offal represent an excellent source of proteins, vitamins, and minerals [3].

Kokorec, an offal product, is prepared from fresh and washed lamb or mutton intestines around mesenterial fat and cooked in different ways; grilled, fried, boiled or tandoori cooked. The most popular cooked process is that wrapped intestines around a skewer are grilled horizontally on a charcoal fire which gives it an extra rich flavor and chopped, seasoned with salt, pepper and oregano, and served on bread.

It has been reported by various researchers that meat and meat products may contain pathogens such as *Clostridium*, *Campylobacter*, *Listeria*, *E. coli*, *Salmonella*, *Brucella* and *Staphylococcus* because of the ruminants as it includes various pathogens of intestinal flora [4, 5, 6]. It may include the potential health risks if not carried out completely the essential hygiene and sanitation conditions and/or adequate

cooking process during the preparation of the intestine. These health risks are microbiological character. In Turkish Food Codex Communiqué on Microbiological Criteria, in meat and meat products, *Salmonella*, *E. coli* O 157 and *Listeria monocytogenes* (*L. monocytogenes*) must be negative in 25 g sample and the number of total mesophilic aerobic bacteria (TAMB) must be no more than 5×10^6 g sample [7].

In this study, it was investigated the certain microbiological parameters of raw kokorec samples made in a specific slaughterhouse and their samples prepared with two different cooking methods as grilled and tandir ovened.

2. MATERIALS AND METHODS

In October-April period, it was taken monthly 60 kokorec samples each about 1 kg cleaned and skewered. Each sample was prepared in 3 different skewers, totally 120 samples. First skewers for raw samples, second and third skewers after grilled and tandir ovened were brought to the laboratory under sterile bags and cold chain. Samples were stored in the refrigerator at 4 ± 2 °C during the analysis. Some physicochemical properties of the raw kokorec samples are summarized in Table 1.

Dry matter, protein content, fat rate and the amount of ash of example were determined according to ISO [8, 9, 10, 11]. For microbiological analysis, sample preparation, TMAB, coliform and *E. coli*, *Salmonella*, *S. aureus* and *C. perfringens* were determined according to FDA BAM [12, 13, 14, 15, 16, 17]. Also *E. coli* 0157:H7 was determined according to Luciano et al., [18].

Table-1: Some physical-chemical properties identified in samples of raw kokorec (n=60)

	Dry Matter (%)	Fat (%)	Protein (%)	Ash (%)
Maximum	23.65	8.12	14.34	1.31
Minimum	20.47	6.12	11.57	1.08
Average	21.85	7.00	12.97	1.20

n= the number of examined samples

3. RESULTS

Microbiological quality characteristics of raw, grilled and tandir ovened samples are presented in Table 2. The number of TAMB were found between 1.2×10^6 and 1.2×10^8 , and to average of 3.8×10^7 cfu/g in raw sample, between 1.1×10^3 and 6.0×10^4 and to average 2.3×10^4 cfu/g, respectively.

Coliform bacteria counts were found between $1,0 \times 10^3$ and $8,4 \times 10^4$, and to average of $2,2 \times 10^4$ cfu/g in the raw samples. Also coliform bacteria counts were found as average of $5,7 \times 10^1$ and $8,6 \times 10^1$ cfu/g in grilled and tandir ovened samples, respectively.

Coagulase (+) *S. aureus* was detected between 1.5×10^3 and 9.6×10^3 , $<1.0 \times 10^1$ and 8.9×10^2 , and 2.5×10^1 and 3.1×10^2 in raw, grilled and, tandir ovened samples, respectively. While *E. coli* was detected in all raw samples, *E. coli* 0157:H7, *C. perfringens* and *Salmonella* were detected in 9 (15%), 18 (45%) and 54 (90%), respectively. As *E. coli* and *Salmonella* were detected in 3 (5%) in grilled samples, *E. coli* 0157:H7 and *C. perfringens* were not detected in any of the grilled samples. On the other hand, it was detected *E. coli* in 24 (40%) and *Salmonella* in 42 (70%) in tandir ovened samples. Also *E. coli* 0157:H7 and *C. perfringens* were not detected in any of the tandir ovened samples.

Table-2. The microbiological characteristics of raw, grilled and tandir ovened kokorec samples (n=60)

Samples	n*	Microorganism	Maximum	Minimum	Average	Positive number ⁺	(%)
Raw	60	TMAB (cfu/g)	1.2×10^8	1.2×10^6	3.8×10^7		
		Coliform (cfu/g)	8.4×10^4	1.0×10^3	2.2×10^4		
		<i>S. aureus</i> (cfu/g)	9.6×10^3	1.5×10^3	3.2×10^3		
		<i>E. coli</i>				60/60	(100)
		<i>E. coli</i> 0157:H7				9/60	(15)
		<i>C. perfringens</i>				18/60	(45)
Grilled	60	<i>Salmonella</i> spp.				54/60	(90)
		TMAB (cfu/g)	5.5×10^3	$<1.0 \times 10^1$	1.2×10^3		
		Coliform (cfu/g)	5.2×10^2	$<1.0 \times 10^1$	5.7×10^1		
		<i>S. aureus</i> (cfu/g)	8.9×10^2	$<1.0 \times 10^1$	1.2×10^2		
		<i>E. coli</i>				3/60	(5)
		<i>E. coli</i> 0157:H7				0/60	(0)
Tandir Ovened	60	<i>C. perfringens</i>				0/60	(0)
		<i>Salmonella</i> spp.				3/60	(5)
		TMAB (cfu/g)	6.0×10^4	1.1×10^3	2.3×10^4		
		Coliform (cfu/g)	6.4×10^2	$<1.0 \times 10^1$	8.6×10^1		
		<i>S. aureus</i> (cfu/g)	7.6×10^2	2.5×10^1	3.1×10^2		
		<i>E. coli</i>				24/60	(40)
<i>E. coli</i> 0157:H7				0/60	(0)		
<i>C. perfringens</i>				0/60	(0)		
<i>Salmonella</i> spp.				42/60	(70)		

*n: examined sample number

⁺ Numbers detected in the detection limit was evaluated as positive.

4. DISCUSSION

In a research, *Salmonella* was identified in 2 (4%) raw and in 6 (12%) cooked offal samples consists of brains, cheeks, tongue, tripe and liver [19]. Also Ulutürk were found positive for *Salmonella* in 40% brain, 24% spleen, 20% liver, 20% lungs, 20% tripe and 12% heart out of 150 raw offal samples [20]. According to the results of another research, while TMAB, coliform and *E. coli* were detected as between 105-107; 104-107 and 101-106 cfu/g in raw kokorec samples, respectively. In the same study, *S. aureus* and *Salmonella* were not detected in any of the samples [21]. Hampikyan et al. found TMAB, coliform, *E. coli* and

S. aureus as between 5.3×10^3 - 7.0×10^5 ; $<1.0 \times 10^1$ - 2.1×10^4 ; $<1.0 \times 10^1$ - 6.6×10^2 and $<1.0 \times 10^2$ - 4.8×10^3 cfu/g in 15 grilled kokorec samples presented for consumption in Istanbul, respectively. Also, there was not detected *Salmonella* in any of the samples in the same study [22]. In a research on microbiological quality of kokorec presented in Afyonkarahisar for consumption, TAMB, Enterobacteriaceae, coliform, *E. coli*, *Enterococcus* spp., *Staphylococcus/Micrococcus* and yeasts and moulds were found as 1.9×10^6 , 2.2×10^4 , 2.7×10^2 , 1.2×10^2 , 1.5×10^4 , 7.1×10^2 and 7.8×10^5 cfu/g, respectively [23].

In this research, the presence of *E. coli* in all, *E. coli* O157:H7 in 15% (9/60), *C. perfringens* in 45% (27/60) and *Salmonella* in 90% (54/60) raw samples indicates that the cleaning was not enough during the sample preparation. Also, according to these results, it has been shown that the most effective cooking process is grilled. The presence of *E. coli* in 40% (24/60) and *Salmonella* in 70% (42/60) demonstrated that the heat treatment was not enough in tandir ovened cooking.

3. CONCLUSIONS

It is necessary to comply with the hygiene processes during the preparation and cleaning of intestine because of kokorec is likely to be contaminated with enteric microorganisms as of natural structure. In addition, the temperature should be to reach the midpoint of product in the cooking process for inhibition of pathogens likely to be found in raw product.

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