

The Microbiological Quality of Tantuni*

Ümit Selçuk¹ Sema Ağaoğlu²

¹Food, Agriculture and Livestock Provincial Directorate, Burdur, Turkey,

²Department of Food Hygiene and Technology, Faculty of Veterinary Medicine, Cumhuriyet University, Sivas, Turkey

Correspondence: Sema Ağaoğlu (sagaoglu@cumhuriyet.edu.tr)

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ABSTRACT

Objective: In this study, microbiological quality of tantuni that have been consumed in the province of Van was examined.

Materials and Methods: For this purpose; 100 tantuni samples, whose 79 of them were red meat tantuni (raw and cooked) and 21 of them chicken tantuni (raw and cooked) were used as material.

Results: According to analysis findings with regard to aerobic mesophilic organisms, coliform group microorganisms, *E. coli*, *micrococcus/staphylococcus*, *S. aureus*, *C. perfringens* and yeast-mould at the samples of raw and cooked red meat tantuni were found to be 5.67 and 3.98, 2.88 and 0.21, 0.87 and 2.00, 2.99 and 2.27, 1.33 and 0.25, 0.05 and 1.00, 4.43 and 0.63 log cfu/g respectively. In the same order, at the samples of raw and cooked chicken tantuni were found to be; 4.35 and 3.77, 2.84 and 1.00, 1.15 and 2.00, 0.95 and 1.22, 2.00 and 2.00, 1.00 and 1.00, 4.05 and 0.11 log cfu/g respectively. *Salmonella* spp. could not be isolated in the tantuni samples that had been investigated. In the raw red meat tantuni samples 5.26% (1/19) had *S. aureus*, in the cooked red meat tantuni samples 1.66% (1/60) had *S. aureus*, and 3.33% (2/60) yeast-mould which were not compatible with the limit values that were stated at the Turkish Food Codex were found. However, values obtained from this study show that during preparation and production of the goods and in the other stages; hygienic rules have not been carried out.

Conclusion: In conclusion to secure the product safety, it is essential to be cautious for the temperature and time during preparation, reservation temperature and GMP/GHP based applications in the preparation of tantuni.

Keywords: Tantuni, Microbiology, Quality

INTRODUCTION

Nutritional habits have changed in parallel with the developing technology and economic changes in recent years. With this change, the demand for fast food-style ready-made food increased rather than traditional dishes. Fast food is generally defined as, "light food that is prepared in a short time and takes little time to eat". Fast food is preferred by working class and students especially because of its practical and economical way of eating. This culture has also been adopted in Turkey. Simit, toast, doner,

lahmacun, pide, hamburger, cold sandwiches, pizza, fish-bread and tantuni are the most consumed fast food types in our country (Akdağ 2015, Cömert 2014, Yaman 2007).

In the selection of fast food products, taking into account the principles of nutrition, besides the hygienic conditions in production, service, storage and sales stages are important for food safety and public health. In these kinds of food, primarily the raw material, spices, other additives, tools-equipments (chopping board, slicer, mixer and

grinders), working personnel and environmental conditions, constitute a potential risk of contamination (Alemdar and Ağaoğlu 2000, Baysal and Küçükaslan 2009, Coşkun 2010, Demirci 2014, Gökten and Tunçel 2010, Koçak 2007).

Tantuni, which is one of the fast foods of Turkey, is a type of wrap that is unique to Mersin. It is made from beef, sheep or chicken meat according to the preference. The meat is cooked on a special plate after adding the minced meat or chicken meat, spices and oil. Tantuni is widely consumed in every region in our country (Merdol 2015).

In this study, the microbiological quality of the red meat tantuni and chicken tantuni taken from the restaurants in Van and the compatibility of the data with the public health were investigated. Study findings were evaluated by taking into account the microbiological criteria (Table 1), for raw meat and heat processed meat products in Turkish Food Codex (TGK, 2010) and the studies in red meat, chicken meat and various meat products (meat, hamburger, doner, Iskender kebab).

Table 1. Microbiological criteria of raw meat and heat processed meats

Meat and Meat Products	Microorganism	Sample		Limits	
		n	c	m	M
1. Carcass of slaughter animals, raw red meat and minced meat, poultry carcass and raw poultry meat	Number of aerobic colonies	5	2	5x10 ⁵	5x10 ⁶
	Coagulase (+) <i>S. aureus</i>	5	2	10 ³	10 ⁴
	<i>Salmonella</i> spp.	5	0	0/25 g	
	<i>L. monocytogenes</i>	5	0	0/25 g	
	<i>E. coli</i> O157: H7	5	0	0/25 g	
2. Heat processed meat products (sausage, salami, Sauteed meat, doner, Meatball, tantuni etc.)	Yeast and mold	5	2	10 ²	10 ³
	Coagulase (+) <i>S. aureus</i>	5	2	10 ²	10 ³
	<i>C. perfringens</i>	5	2	10 ²	10 ³
	<i>Salmonella</i> spp.	5	0	0/25 g	
	<i>L. monocytogenes</i>	5	0	0/25 g	
	<i>E. coli</i> O157: H7	5	0	0/25 g	

n: Number of samples to be analysed; c: The number of samples to be considered containing the maximum number of microorganisms between m and M; m: (n - c) the maximum number of microorganisms that can be found in 1 gram of the sample to be analysed; M: The maximum number of microorganisms acceptable per 1 gram of sample to be analyzed in c number

MATERIALS and METHODS

Material

In this study, a total of 100 tantuni samples including 79 red meat tantuni and 21 chicken tantuni were used as material. The samples were collected from the restaurants in the Van province. 60 of the red meat tantunis were cooked, 19 were raw; 13 of the chicken tantuni were cooked, 8 of them were taken as raw. The sample's amount being not less than 200 g. was paid attention. In aseptic conditions, samples were taken in sterile stomacher bags in cold chain and brought to YYU Faculty of Veterinary Medicine the Department of Food Hygiene and Technology and the microbiological analysis were performed on the same. The samples were kept in the refrigerator until the analysis was finalized.

Preparation of samples

For the determination of the number of aerobic mesophilus general live, coagulase (+) *Staphylococcus aureus*, coliform microorganism, *Escherichia coli*, *Clostridium perfringens* and yeast-mold, by adding 90 ml of 0.1% sterile peptone water over 10 g of sample in the stomacher for 2 min., sample was homogenized. Then, 1: 10 consecutive dilutions of the samples with the same diluent were prepared and double-parallel plantings were carried out in the respective media *Salmonella* spp., in isolation 25 g of the sample was homogenized with 225 ml of Peptone Water (Buffered) (BPW, Merck 1.07228). The mixture was incubated at 37°C for 18 hours and was pre-enriched (Halkman, 2005).

Method

Plate Count Agar (PCA, Merck 1.05463) medium was used in the aerobe mesophilic general viable count. The plaques that were sown with cast

method were evaluated by incubating at 37 °C for 48 hours (aerobic). Baird-Parker Agar Base (BP, Merck 1.05406) with the addition of Egg Yolk Telluride (Merck 1.03785) was used for micrococcus / staphylococcal count. Plates were incubated at 37°C for 24-48 hours (aerob). To determine the number of coagulase (+) *S. aureus*, we switched from the suspected colonies developed in BP to Brain Heart Infusion Broth (Oxoid CM225). Tubes were incubated at 37°C for 24 hours in an aerobic medium. Violet Red Bile Agar (VRBA, Merck 1.01406) was used for coliform microorganism counting (double coat cast y.). Plates were incubated at 37°C for 24 hours in an aerobic medium. *E. coli* number was determined by sowing with TBX Agar medium spreading method. Plates were first incubated at 30°C for 4 hours, then at 44°C for 18 hours in an aerobic medium. Tryptose Sulfite Cyclocerine Agar (TSC, Merck 1.11972) with TSC agar added (Merck 1.00888) was used for the detection of *C. perfringens*. Plates were incubated at 35°C for 18-24 hours in an anaerobe medium. Potato Dextrose Agar (PDA, Merck 1.10130) was used in the yeast-mold count. Plates were incubated at 22-25°C for 5 days in an aerobic medium. *Salmonella* spp. Buffered Peptone Water (BPW, Merck 1.07228) was used for pre-enrichment. Rappaport Vassiliadis Soy Broth (RVS, Merck 1.07700) was seeded and the tubes were incubated at 41.5°C for 24 hours in an aerobic medium. After selective enrichment, Xylose-Lysine-Deoxycholate (XLD, Merck 1.05287) was plotted on agar and the plates were incubated at 37°C for 24 hours. Biochemical tests (indole, voges proskauer (VP), citrate, β -glucuronidase, coagulase, movement, nitrate and lactose gelatin) were applied in isolation and identification of microorganisms. Dryspot staphylect plus (Oxoid DR100M) and Singlepath Salmonella (Merck 1.04140) were serologically tested (Halkman 2005).

Statistical analysis

SPSS 19.0 package program was used for statistical analysis of microbiological data of Tantuni samples (Sumbulluoglu and Sumbulluoglu 2014).

RESULTS

The average microorganism levels of Tantuni samples are shown in Figure 1 and Figure 2 and the logarithmic values are given in Table 2.

According to the findings of analysis; The average number of aerobic mesophilus general living, coliform group microorganisms, *Micrococcus* /

Staphylococcus and yeast-mold were found higher in red meat tantuni (raw and cooked) (Table 2). The aerobe mesophils in the raw red meat tantuns are generally live, coliform microorganisms, *E. coli*, *Micrococcus* / *Staphylococcus*, coagulase (+) *S. aureus*, *C. perfringens* and yeast-mold were respectively detected as 100% (19/19), 89.47% (17/19), 31.57% (6/19), 78.94% (15/19), 42.1% (8/19), 5.26% (1/19) and 100% (19/19). In cooked samples, these values were 95% (57/60), 6.66% (4/60), 0%, 70% (42/60), 8.33% (5/60), 0% and 28.33% (17/60) determined. *Salmonella* spp. In raw red meat tantuni; *E. coli*, *Salmonella* spp. and *C. perfringens* could not be isolated (Table 2, Figure 1).

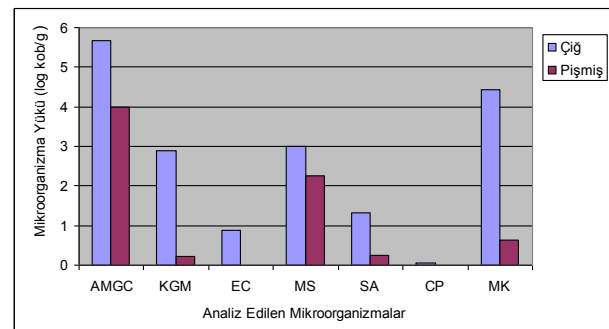


Figure 1. Average microorganism levels in raw and cooked red meat tantuni

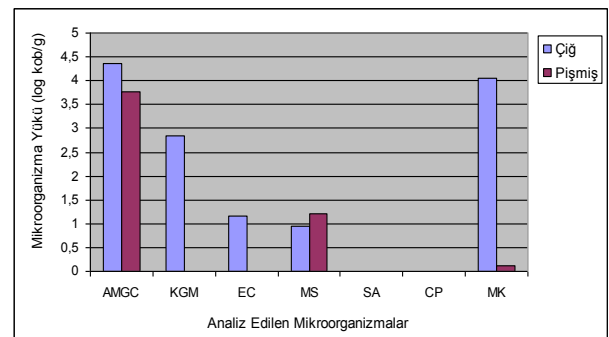


Figure 2. Average microorganism levels in raw and cooked chicken tantuni

The percentage of aerobic mesophilic in the raw chicken tantunis is 100% (8/8), 100% (8/8), 50% (4/8), 37.5%, respectively. (3/8) and 100% (8/8). In the cooked samples, the ratio of aerob mesophilic, *Micrococcus* / *Staphylococcus* and yeast-mold were 100% (13/13), 46.15% (6/13) and 7.69% (1/13) respectively. Coagulase (+) *S. aureus*, *Salmonella* spp. and *C. perfringens*; cooked samples of coliform microorganism, *E. coli*, coagulase (+) *S. aureus*, *Salmonella* spp. and *C. perfringens* could not be isolated (Table 2, Figure 2).

Table 2 Logarithmic values of microorganisms detected in Tantuni samples (log cfu / g)

Sample	n		AMGL	KGM	EC	MS	SA	S (in 25 g)	CP	YM
Materiality (P)			***	***	***	**	***		*	***
Raw red meat	19	Min.	4.68	<1.00	<2.00	<2.00	<2.00	-	<1.00	3.34
		Max.	6.60	4.68	3.62	5.90	4.30	-	1.00	5.30
		X	5.67 ^a	2.88 ^a	0.87 ^a	2.99 ^a	1.33 ^a	-	0.05	4.43 ^a
		Sx	0.623	1.158	1.354	1.821	1.669	-	0.229	0.658
Cooked red meat	60	Min.	<1.00	<1.00	<2.00	<2.00	<2.00	-	<1.00	<1.00
		Max.	6.78	4.78	<2.00	4.45	3.60	-	<1.00	3.72
		X	3.98 ^b	0.21 ^b	<2.00 ^b	2.27 ^{ab}	0.25 ^b	-	<1.00	0.63 ^b
		Sx	1.319	0.899	<2.00	1.595	0.852	-	<1.00	1.116
Raw chicken	8	Min.	3.00	2.30	<2.00	<2.00	<2.00	-	<1.00	3.26
		Max.	5.41	3.78	2.30	3.00	<2.00	-	<1.00	5.13
		X	4.35 ^b	2.84 ^a	1.15 ^a	0.95 ^c	<2.00 ^b	-	<1.00	4.05 ^a
		Sx	0.762	0.561	1.229	1.328	<2.00	-	<1.00	0.681
Cooked chicken	13	Min.	2.60	<1.00	<2.00	<2.00	<2.00	-	<1.00	<1.00
		Max.	6.90	<1.00	<2.00	3.28	<2.00	-	<1.00	1.48
		X	3.77 ^b	<1.00 ^b	<2.00 ^b	1.22 ^{bc}	<2.00 ^b	-	<1.00	0.11 ^b
		Sx	1.397	<1.00	<2.00	1.418	<2.00	-	<1.00	0.410

*: P>0.05; **: P<0.01; ***: P<0.001; -: Could not be detected; ^{a, b, c}; The difference between the averages indicated by different letters in the same column is important; **AMGL**: Aerob Mesophyll General Live, **KGM**: Coliform Group Microorganism; **EC**: *E. coli*, **MS**: *Micrococcus / Staphylococcus*, **SA**: *S. aureus*, **S**: *Salmonella* spp., **CP**: *C. perfringens*, **YM**: yeast mold

DISCUSSION

In this study, the microbiological quality of the tantunis which are offered in restaurants in Van was examined. As material, 100 tantuni samples were taken for analysis.

According to the findings of analysis; the overall number of live aerobe mesophils was between 4.68-6.60 log cfu / g in raw red meat tantuni and 5.67 ± 0.623 log cfu / g, and $<1.00-6.78$ log cfu / g in cooked ones and 3.98 ± 1.319 log cfu / g. This number was found to be between 3.00-5.41 log cfu / g in the raw chicken tantunis and 4.35 ± 0.762 log cfu / g in the cooked ones, between 2.60-6.90 log cfu / g and 3.77 ± 1.397 log cfu / g in the cooked ones (Table2).

Aerob mesophilic general living level of Anar and Temelli (2000) raw Iskender samples of 6.52, 2.60 cooked; Cebirbay (2007) 4.97 in the raw doner; Gencer and Kaya (2004) in cooked revolutions 5.1; Kayışoğlu et al. (16) at 5.68 in raw doner, 4.92 in cooked doner; 5.11 with raw earrings (Kupeli 1996); Öztürk (2007) were identified 5.22 log cfu/g in minced meat samples. The overall viable level in Tantuni samples does not correspond to the findings of the investigators.

Total bacterial count is an important criterion in determining microbiological quality in foods. The high number of this shows that the hygiene of the enterprise is insufficient (26).

In the Turkish Food Codex (TGK 2010), the total number of bacteria in raw red meat and poultry meat was reported to be 6.70 log cfu / g. Limit value is not given in heat processed meat products. In Tantuni samples (raw), the number of determined general populations was found to be appropriate for this limit.

Coliform microorganisms are important as hygiene indicators in food analysis. The presence of coliform microorganisms in foods is a sign of fecal contamination and insufficient sanitation (Turgay 2017).

The number of coliform microorganisms was 2.88 ± 1.158 for raw red meat tantuni and 0.21 ± 0.899 for cob/g for cooked ones. This number was determined as 2.84 ± 0.561 log cfu/g in raw chicken tantuni. No coliform microorganism was detected in cooked chicken tantunis (Table 2).

In the samples the level of coliform microorganism was found in Anar and Temelli (2000) 5.41 raw Iskender; Cebirbay (2007) 1.46 in raw doner; Kayışoğlu et al. (2003) 4.79 in raw doner, 2.88 in cooked doner; Öztürk (2007) found 4.51 log cfu / g

in minced meat samples. Although the level of coliform microorganism determined in Tantuni was higher than the value reported by Cebirbay (2007), it was found lower than the results of other researchers (Anar and Temelli 2000; Kayışoğlu et al. 2003).

In the Turkish Food Codex (TGK 2010), the limit value for coliform microorganism levels in raw red meat, poultry meat and heat treated meat products is not given. In the tantuni samples analyzed, the presence of coliform microorganisms can be explained by improper sanitation conditions, inadequate cooking or possible contamination after the process.

Escherichia coli is found naturally in the intestinal flora of humans and animals. Some species are pathogenic and cause urinary tract infections and gastroenteritis in humans (Turgay 2017).

The average number of *E. coli* in raw red meat tantuni and chicken tantuni was 0.87 ± 1.354 and 1.15 ± 1.229 log cfu / g, respectively (Table 2). *E. coli* could not be isolated in cooked tantuni. *E. coli* ratio was determined as 31.57% in raw red meat tantuni and 50% in raw chicken tantuni.

In the studies conducted in our country, *E. coli* rate is 40% in Anar and Temelli (5) raw Iskender samples; 32.5% in cooked Gencer and Kaya (2004) cooked döner; 4% in chicken breasts

Efe and Gümüşsoy (2005); Baydur (2006) was 53.3% in chicken wings and 50% in chicken leg; Tuncer was (2008) determined 36% in cattle carcasses. The rate of *E. coli* detected in raw chicken tantuni was similar to that of Baydur (2006). In contrast, some investigators (Anar and Temelli 2000) reported that they did not detect *E. coli* in cooked samples of Iskender doner. The absence of *E. coli* in cooked tantuni is consistent with the results of these investigators.

In Turkish Food Codex (TGK 2010), no limit value was given for *E. coli* in raw meat and poultry meat and heat processed meat products. Because the presence of *E. coli* in fecal origin in foods, it indicates the possibility of direct or indirect fecal contamination and the presence of enteric pathogens (Turgay 2017). The absence of *E. coli* in cooked tantuni is a positive finding in terms of public health.

Staphylococcus aureus is a bacterium that is frequently found in the flora of people's mouth and nose and hands. Food processors and dirty equipment that are carriers of *Staphylococcus aureus*

pose a potential risk of contamination (Turgay 2017).

According to the analysis findings, the mean number of *Micrococcus* / *Staphylococcus* was determined 2.99 ± 1.821 and 2.27 ± 1.595 log cfu / g in the raw and cooked red meat tantunis, respectively. This number was detected as 0.95 ± 1.328 and 1.22 ± 1.418 log cfu / g in raw and cooked chicken tantunis (Table 2). The ratio of *Micrococcus* / *Staphylococcus* was 78.94% in raw red meat tantuni, 70% in cooked ones; 100% of the raw chicken tantuni, and 46.15% of the cooked ones.

The mean number of coagulase (+) *S. aureus* was 1.33 ± 1.669 and 0.25 ± 0.852 log cfu/g in raw and cooked red meat tantunis, respectively. *S. aureus* could not be isolated in chicken tantuni (Table 2). *Staphylococcus aureus* ratio was 42% in raw red meat tantuni and 8.33% in cooked ones.

Coagulase (+) *S. aureus* level was identified in Ozturk (2007) minced meat 3.42; in doner samples of Cebirbay (2007) 2.07 log cfu / g. Ağaoğlu et al. (2000) reported that they could not isolate coagulase (+) *S. aureus* in hamburger and chicken burgers and Anar and Temelli (2000). Coagulase (+) *S. aureus* ratio was determined (2004) 40% in cooked doner of Gençer and Kaya; 32% in raw doner of Topçu (2006) and 20% in cooked doner; 30.5% of cattle carcasses of Tuncer (2008). The rate of *S. aureus* detected in cooked red meat tantuni was lower than the results of these investigators.

In Turkish Food Codex (TGK 2010); Coagulase (+) *S. aureus* number was determined as 4.00 log cfu / g in raw red meat and poultry. This level of heat processed meat products has been reported as 3.00 log cfu / g. In this study, 5.26% (1/19) of raw red meat tantunis and 1.66% (1/60) of cooked samples were not found to be suitable for Turkish Food Codex in terms of coagulase (+) *S. aureus*. This finding can be explained by the lack of hygiene during production and service or contamination after cooking process.

Salmonella in the family of *Enterobacteriaceae* are found in the intestinal system of human and warm-blooded animals. Red meat and poultry meat are risky foods in Salmonella infections. Salmonella carriers are a potential source of contamination and spread of infection (Turgay 2017).

In this study, *Salmonella* spp. could not be isolated (Table 2). In the studies carried out in our country, the rate of Salmonella is found out to be between 3.3%- 10% in chickens by Ağaoğlu and Güdücüoğlu (1999); by Anar and Temelli (2000) 10% in the

samples of raw Iskender; by Efe and Gümüşsoy (2014) 16% in chicken breast; Kayısoğlu et al. (2003) cooked chicken doner and red meat doner respectively 40% and 80%. Anar and Temelli reported that (2000) no *Salmonella* spp. was found in the cooked samples of Iskender and doner by Gençer and Kaya (2004); Tuncer (2008) in cattle carcasses.

In Turkish Food Codex (TGK 2010); raw red meat, poultry and heat processed meat products in 25 g *Salmonella* spp. is not to be found. Tantuni samples examined were found appropriate in Turkish Food Codex in terms of *Salmonella* spp. This finding is consistent with the results of some researchers (Anar and Temelli 2005; Tuncer 2008). *Salmonella* spp. not being detected is an important finding in terms of public health.

Clostridium perfringens is a pathogen found naturally in the intestinal flora of humans and animals. The sporulation of enterotoxin in the small intestine of the bacterium causes infections. Pre-cooked slow chilled food, poses a potential risk of poisoning of insufficient cooking and inadequate heating (Turgay 2017).

In the studies, *C. perfringens* ratio is detected in Gençer and Kaya (2004) 15% in cooked doner and in Kayısoğlu et al. (2003) 80% of raw doner and in Tuncer (2008) had 9.5% in cattle carcasses.

In the Turkish Food Codex (TGK 2010), the limit value for *C. perfringens* level in heat processed meat products was determined as 3.00 log cfu / g. However, no limit value is given for raw red meat and poultry meat. In this study, *C. perfringens* (0.05 ± 0.229 log cfu / g) was detected in only one sample of raw red meat tantunis (Table 2). Tantuni samples were found to be suitable for *C. perfringens* according to Turkish Food Codex.

Yeast and mold microorganisms are commonly found on soil, water, air and organic materials. Yeast and molds with saprophytic properties cause flavor loss, color defect and texture defects in foods and some mold species cause intoxications in humans and animals by producing toxin (Turgay 2017).

In this study, yeast-mold level was determined as 4.43 ± 0.658 in raw red meat tantunis, 0.63 ± 1.116 in cooked ones, 4.05 ± 0.681 in raw chicken tantunis, and 0.11 ± 0.410 log cfu / g in cooked ones (Table 2). Yeast-mold ratio was found to be 100% in raw red meat tantunis, 28.33% in cooked ones, 100% in raw chicken tantunis and 7.69% in cooked ones.

The level of yeast and mold; was detected by Anar and Temelli (2000) 4.53 in raw Iskender samples, 3.48 in cooked ones; by Kayısoğlu et al. (2003) 4.96 raw doner 3.35 in cooked doner; Baydur (2006) was found to be 3.36-4.23 log cfu / g in pieces of chicken meat. The rate of yeast-mold was found in Baydur (2006) 70% of chicken wing meat, 43.3% chicken leg meat and 53.2% in chicken breast meat. The rate of yeast-molds detected in raw tantuni was higher than the results of these researchers. Similarly, the level of yeast-mold does not coincide with these findings.

In the Turkish Food Codex (TGK 2010), the yeast-mold level should not exceed 3.00 log cfu / g in heat processed meat products. However, there is no limit value for raw red meat and poultry meat. 3.33% (2/60) of cooked red meat tantuni was found to be unsuitable for Turkish Food Codex in terms of yeast-mold. The level of yeast-mold was found in level value in 2 samples (3.33%) of the cooked red meat tantuni.

Yeast and mold microorganisms are an important quality criterion in foods that are kept under natural atmospheric conditions or in foods that are cooled or frozen. The development of yeast-mold in the investigated tantuni can be explained by the unhygienic production conditions.

According to the research findings, the hygienic quality of cooked chicken tantunis was found to be relatively better. However, when a general evaluation is made, it is understood that the production of the tantuni and the hygienic rules in other stages are not taken enough care.

The hygienic quality of raw materials, spices and other additives used in the production of tantuni, tools-equipment, personnel hygiene, operation sanitation, heat-time combinations used in meat cooking and faulty practices may cause cross contamination and have an effect on quality (Tayar et al. 2015; Toprak 2000).

CONCLUSION

In conclusion; taking into account the GMP / GHP based applications in the preparation of tantuni, and conducting the necessary inspections by the authorized institutions are important for the product safety and public health.

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