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# A Microbiological Evaluation on the Ready-To-Eat Red Meat and Chicken Donair Kebabs from a Local Catering Company in Bursa

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## ABSTRACT

**This study was performed to evaluate the microbiological quality of the ready-to-eat red meat and chicken donairs from a catering company in Bursa. Samples were examined for total aerobic mesophilic bacteria, coliforms, *Escherichia coli* (*E. coli*), enterococci, staphylococci, coagulase positive staphylococci, and *Salmonella* spp. Temperatures used in this company were found sufficient for donair surface cooking. The collection tray and the personnel hands were determined as the main cross and/or post contamination sources for the donair ready for service.**

**Key Words: Donair, microbiological quality, contamination sources, ready to eat meat, kebab.**

## INTRODUCTION

Donair is a traditional Turkish meat dish, which is prepared by mixing minced and/or flattened meat (beef and/or lamb, poultry) and animal fat, seasoned and molded vertically around a skewer to form a cone shape, and then cooked rotating vertically in front of a heating element powered by electric, gas or charcoal (Anonymous 2006a, b). This gradually cooked meat is then cut into thin slices on a collection tray, which are served either on a plate, or as a fast food sandwich with herbs, salads or dressings. Microbiological quality problems in donair depend largely on the following factors: low inital quality of raw meat and/or other ingredients, inefficient cooking process, improper sanitary practices for personnel, and for cooking/processing utensils (Vazgecer et al. 2004, Kayaardı et al. 2006). One or several of these factors may lead to potential health hazards for humans (Evans et al. 1999, Harakeh et al. 2005).

This study aimed both to evaluate the microbiological quality of the ready-to-eat red meat and chicken donairs from a local catering company, and to identify the main microbiological contamination sources.

## MATERIALS and METHODS

The samples collected in 10 individual times between June- August 2006, from a local catering company in Bursa are: *a. From processing stages*: raw meat (beef:lamb 15% + veal 85%; chicken: skinless boneless chicken breast), raw donair (seasoned for 12 h at 4°C and molded around skewer), cooked donair (in electrical oven), donair ready-for service on collection tray; *b. From possible contamination sources:* sauce used for seasoning (onion juice, milk, salt, tomato paste [only for chicken donair]), collection tray, donair cutting knife, service tong, and personnel hands. Samples stored in coolers were analysed within 2 h after transferring to the laboratory. Cooked donair temperatures were measured at 0.5 cm depth.

For microbiological analyses from processing stages of donair and from the sauce for seasoning, 25 g sample was added into 225 ml of sterile 0.1% peptone water (OXOID, CM 9), and homogenized in a stomacher (Seward Medical Head Office, BA 6020 Model, London, England). Serial decimal dilutions were made and plated as duplicates for bacterial counts.

Swab methods (Eisel et al. 1998) and glove methods (De Wit and Kampelmacher 1988) were used for the microbiological analyses of collection tray, donair cutting knife, service tong and personnel hands, respectively.

All samples were analysed for the determination of following bacteria: **1.** TAMB count: by spread plate method onto PCA (OXOID CM 325) with aerobic incubation at 30°C for 48 h (Elmalı et al. 2005). **2.** Coliforms and *E. coli* count: by pour plate method in VRBA (OXOID CM 107), with aerobic incubation at 37°C for 24 h. Five typical *E. coli*-suspect colonies were transferred to Lactose Broth (OXOID CM 137) and incubated at 37°C for 48 h. Cultures with gas and turbidity were subcultured to EMBA (OXOID CM 69) and incubated at 37°C 24 h., and biochemically characterized by IMViC tests (Elmalı et al. 2005). **3.** Enterococci

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count: by spread plate method on SBM (OXOID CM 377) for 24 h aerobic incubation at 37°C (Anar and Temelli 2000). **4.** Staphylococci and coagulase positive staphylococci count: by spread plate method on BPA (OXOID CM 275) with aerobic incubation at 37°C for 24 h. Five coagulase positive-suspect colonies were transferred to BHIB (OXOID CM 225), incubated at 37°C for 24 h, and were applied on to Staphylase Test kit card (OXOID DR 595) (The Oxoid Manual 1998). **5**. *Salmonella* spp.detection: as indicated by Andrews and Hammack (2007), sample was preenriched in Lactose Broth at 37°C for 24 h, and 1 ml was transferred to 10 ml Tetrathionate Broth for enrichment, incubated at 37°C for 24 h. Subcultures were streaked onto XLD and XLT-4 agars. Suspect colonies were confirmed by biochemical and serological tests when required.

## RESULTS

Microbiological analysis results from processing stages and the possible contamination sources of red-meat donair and chicken donair are given in Table 1 and Table 2, respectively. None of the red-meat and chicken donair samples were found to harbor *Salmonella*.

## DISCUSSION

In this study, TAMB, coliform, *E. coli* counts from all processing stages were found similar in both raw donair types, whereas enterococci count was slightly higher in raw chicken donair, and staphyloccoci and coagulase positive staphylococci counts were higher in raw red-meat donairs (Tables 1, 2). Concurrent observations had been reported previously by others (Acar and Çiftçioğlu 1997, Kayisoglu et al. 2003). Counts obtained from contamination sources of both donairs were also similar (Tables 1, 2). Besides from the initial accordance in the counts of raw materials and ingredients, the usage of same cooking temperature and time for the donairs, and the usage of cooking utensils in common with the same personnel might have effect on these similarities.

**Table 1.** Microbiological analysis results from processing stages and possible contamination sources of red-meat donair.

| Samples from | Microorganism*,† | | | | | |
|---|---|---|---|---|---|---|
| | **Total aerobic mesophilic bacteria** | **Coliforms** | ***E. coli*** | **Enterococci** | **Staphylococci** | **Coagulase positive Staphylococci** |
| *processing stages* | | | | | | |
| raw meat | $5.0 \times 10^6$ | $2.1 \times 10^4$ | $3.1 \times 10^3$ n=3 | $2.0 \times 10^3$ | $3.0 \times 10^3$ | $2.1 \times 10^3$ n=2 |
| raw donair | $7.2 \times 10^7$ | $4.3 \times 10^5$ | $8.3 \times 10^3$ n=5 | $8.9 \times 10^3$ | $5.7 \times 10^3$ | $3.2 \times 10^3$ n=3 |
| cooked donair | $1.7 \times 10^3$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $2.1 \times 10^2$ | $< 1.0 \times 10^2$ |
| donair ready-for service | $4.1 \times 10^4$ | $1.2 \times 10^1$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $3.1 \times 10^2$ | $4.1 \times 10^2$ n=2 |
| *contamination sources* | | | | | | |
| sauce | $4.0 \times 10^5$ | $1.7 \times 10^3$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $1.8 \times 10^2$ | $< 1.0 \times 10^2$ |
| collection tray | $8.7 \times 10^5$ | $2.7 \times 10^2$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ |
| cutting knife | $3.2 \times 10^4$ | $1.2 \times 10^2$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ |
| service tong | $6.1 \times 10^3$ | $7.1 \times 10^1$ | $< 1.0 \times 10^1$ | $1.7 \times 10^2$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ |
| personnel hands | $8.2 \times 10^5$ | $3.7 \times 10^3$ | $1.2 \times 10^1$ n=2 | $1.9 \times 10^2$ | $7.3 \times 10^3$ | $5.3 \times 10^3$ n=3 |

*Mean counts determined from n= 10 samples unless otherwise indicated; †cfu/g for processing stage and sauce samples; cfu/swabbed sample for collection tray, cutting knife and service tong; cfu/ml for personnel hands.

**Table 2.** Microbiological analysis results from processing stages and possible contamination sources of chicken donair

| Samples from | Microorganism*, † | | | | | |
|---|---|---|---|---|---|---|
| | **Total aerobic mesophilic bacteria** | **Coliforms** | ***E. coli*** | **Enterococci** | **Staphylococci** | **Coagulase positive Staphylococci** |
| *processing stages* | | | | | | |
| raw meat | $3.7 \times 10^6$ | $7.1 \times 10^4$ | $1.2 \times 10^3$ n=2 | $2.1 \times 10^4$ | $2.2 \times 10^2$ | $3.2 \times 10^2$ n=1 |
| raw donair | $5.3 \times 10^7$ | $3.7 \times 10^5$ | $1.7 \times 10^3$ n=4 | $3.7 \times 10^4$ | $4.7 \times 10^2$ | $3.8 \times 10^2$ n=2 |
| cooked donair | $4.2 \times 10^3$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ |
| donair ready-for service | $5.7 \times 10^4$ | $3.2 \times 10^1$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $6.2 \times 10^2$ | $4.2 \times 10^2$ n=1 |
| *contamination sources* | | | | | | |
| sauce | $6.4 \times 10^5$ | $3.2 \times 10^2$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $3.7 \times 10^2$ | $< 1.0 \times 10^2$ |
| collection tray | $7.2 \times 10^5$ | $4.1 \times 10^3$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $<1.0 \times 10^2$ | $< 1.0 \times 10^2$ |
| cutting knife | $4.3 \times 10^4$ | $1.7 \times 10^2$ | $< 1.0 \times 10^1$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ |
| service tong | $5.7 \times 10^3$ | $6.8 \times 10^1$ | $< 1.0 \times 10^1$ | $2.6 \times 10^2$ | $< 1.0 \times 10^2$ | $< 1.0 \times 10^2$ |
| personnel hands | $7.9 \times 10^5$ | $5.2 \times 10^3$ | $1.4 \times 10^1$ n=1 | $4.2 \times 10^2$ | $8.7 \times 10^3$ | $7.1 \times 10^3$ n=3 |

*Mean counts determined from n= 5 samples unless otherwise indicated; †cfu/g for processing stage and sauce samples; cfu/swabbed sample for collection tray, cutting knife and service tong; cfu/ml for personnel hands

From the aspect of investigated bacteria, raw meats used for both donair types had good hygienic quality, and were in comliance with the Turkish Food Codex (Anonymous 2006a, b) (maximum count [cfu/g]: TAMB $5.0 \times 10^6$; *E. coli* $5.0 \times 10^3$; *S. aureus* $5.0 \times 10^3$).

Raw donair had slightly higher counts than raw meat, and particularly the numbers of samples (n), which were found positive for *E. coli* and coagulase positive staphylococci increased in both donairs (Tables 1 and 2), possibly due to the molding and holding for seasoning all with bare hands (Harakeh et al. 2005). In addition, raw donairs had higher TAMB counts (Tables 1 and 2) than indicated in Turkish Food Codex (Anonymous 2006a, b) (maximum count TAMB $5.0 \times 10^6$ cfu/g).

Average temperatures of cooked red-meat donairs and chicken donairs were 67.98°C and 69.02°C, respectively. These temperatures, although slightly below 70°C, reported to destroy food-poisoning bacteria, and adequate cooking was reported to cause marked reduction particularly in coliforms (Todd et al. 1986, Kayisoglu et al. 2003, Gonulalan et al. 2004). Our cooking temperatures seem to be sufficient for our processes, since cooking the donairs at these temperatures led a 4 and 5 log reduction in TAMB and coliform counts, respectively. All other bacteria were found to be under the detection limits except for staphylococci in red-meat donair (Tables 1 and 2).

Average temperatures sampled from ready-to-eat red-meat and chicken donairs were 36.86°C and 34.10°C, respectively. These temperatures are within the danger zone of 5 to 60°C (15), and presents a good environment for the increase in mesophilic counts (Acar and Çiftçioğlu 1997). In our study, increases in TAMB count, and detection of coliforms, staphylococci and coagulase positive staphylococi (Tables 1 and 2) at this stage, can be explained by cross-contaminations, such as drip from raw donair to cooked donair in the tray, and/or contaminated utensils during this holding. This finding is parellel to the previous reports (Elmalı et al. 2005, Sumner et al. 2005, Abdullahi et al. 2006).

Results from this study indicate the cooking temperatures used in this company were sufficient for the surface of the donairs to be fully-cooked, when bacterial reduction results are taken into account. However, application of good hygienic practices to prevent cross and post contaminations at the specific processing

steps with 'holdings' namely: at raw donair holding after hand molding and seasoning, and at holding the donair ready-for service in tray is advised 'to warrant a safe product' to the consumer.

## REFERENCES

Abdullahi IO, Umoh VJ, Ameh JB, and Galadima M (2006). Some hazards associated with the production of a popular roasted meat (tsire) in Zaria, Nigeria. Food Control 17: 348-352.

Acar MS, and Çiftçioğlu G (1997). Kasaplık hayvan etleri ve tavuk etinden yapılan döner kebapların mikrobiyolojik kalitesi üzerinde bir araştırma. İstanbul Üniv. Vet. Fak. Derg., 23: 395-404.

Anar Ş, and Temelli S (2000). İskender Kebap'ın mikrobiyolojik kalitesinin belirlenmesi. Uludağ Üniv. Vet. Fak. Derg., 19: 13-18.

Andrews WH, and Hammack T (2007). http://www.cfsan.fda.gov/~ebam/bam-5.html.

Anonymous (2006a). Çiğ Kırmızı Et ve Hazırlanmış Kırmızı Et Karışımları Tebliği. Türk Gıda Kodeksi, 2006/31.

Anonymous (2006b). Çiğ Kanatlı Eti ve Hazırlanmış Kanatlı Eti Karışımları Tebliği. Türk Gıda Kodeksi, 2006/29.

De Wit JC, and Kampelmacher EH (1988). Some aspects of bacterial contamination of hands of workers in food service establishments. Zentralbl. Bakteriol Microbiol Hyg B, 186: 45-54.

Eisel WG, Linton LH, and Muriana EH (1998). A survey of microbial levels for incoming raw beef, environmental sources and ground beef in a red meat processing plant. Food Microbiol 14: 273-282.

Elmalı M, Ulukanlı Z, Tuzcu M, Yaman H, and Cavlı P (2005). Microbiological quality of beef doner kebabs in Turkey. Arc. für Lebensmittel 56: 25-48.

Evans MR, Salmon RL, Nehaul L, Mably S, Wafford L, Nolan-Farrel MZ, Gardner D, and Ribeiro CD (1999). An outbreak of Salmonella typhimurium DT170 associated with kebab meat and yogurt relish. Epidemiol Infect 122: 377-383.

Gonulalan Z, Yetim H, and Kose A (2004). Quality characteristics of doner kebab made from sucuk dough which is a dry fermented Turkish sausage. Meat Sci 67: 669-674.

Harakeh S, Yassine H, Gharios M, Barbour E, Hajjar S, El-Fadel M, Toufeili I, and Tannous R (2005). Isolation, molecular characterization and antimicrobial resistance patterns of *Salmonella* and *Escherichia coli* isolates from meat-based fast food in Lebanon. Sci Total Environ 341: 33-44.

Kayaardı S, Kundakçı A, Kayacıer A, and Gok V (2006). Sensory and chemical analysis of doner kebab made from turkey meat. J. Muscle Foods 17: 165-173.

Kayisoglu S, Yilmaz I, Demirci M, and Yetim H (2003). Chemical composition and microbiological quality of the doner kebabs sold in Tekirdag market. Food Control 14: 469-474.

Sumner J, Ross T, Jenson I, and Pointon A (2005). A risk microbiological profile of the Australian red meat industry: Risk ratings of hazard-product pairings. Int. J. Food Microbiol 105: 221-232.

The Oxoid Manual (1998). 8th Ed., 280. Oxoid Ltd.: Hampshire, England.

Todd ECD, Szabo R, and Spiring F (1986). Donairs (Gyros) – Potential hazards and control. J Food Prot 49: 369-377.

Vazgecer B, Ulu H, and Oztan A (2004). Microbiological and chemical qualities of chicken döner kebab retailed on the Turkish restaurants. Food Control 15: 261-264.