

## Prevalence and seasonal distribution of *Salmonella* spp. in frozen raw meats

Naim Deniz AYAZ<sup>1</sup>, Erdem ÖRMECİ<sup>2</sup>, Barış ÖZ<sup>2</sup>

<sup>1</sup>Department of Food Hygiene and Technology, School of Veterinary Medicine, Kırıkkale University, Kırıkkale;

<sup>2</sup>B Type Food Control Detachment Command, Ağrı, Turkey

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**Abstract:** The objectives of this study were to find out the prevalence and seasonal distribution of *Salmonella* spp. in frozen raw meats in Ağrı. *Salmonella* spp. were detected from 37 (17.3%) of the 214 frozen raw meat samples. Out of 70 chicken, 74 turkey, and 70 beef samples, 19 (27.1%), 17 (23.0%), and 1 (1.4%) were contaminated with *Salmonella* spp., respectively. Chicken meat samples were the most prevalent among all other analyzed meat species for *Salmonella* spp. In general 10.7% (6/56), 28.1% (16/57), 12.0% (6/50), and 17.6% (9/51) of the meat samples were found to be contaminated with *Salmonella* spp. during the spring, summer, autumn, and winter, respectively. These results showed that the prevalence of *Salmonella* spp. were higher in raw poultry meat and beef in the summer than other seasons. In the study, high contamination levels in chicken and turkey meats with *Salmonella* spp. were detected. The presence of *Salmonella* spp. in raw poultry meat is an important risk for food hygiene. Poultry meat should be prepared under hygienic conditions in the kitchen to avoid cross contaminations to ready to eat foods and should be cooked well before consumption.

**Key words:** Beef, chicken meat, *Salmonella*, seasonal distribution, turkey meat.

### Dondurulmuş çiğ etlerde *Salmonella* spp. prevalansı ve mevsimsel dağılımı

**Özet:** Bu çalışmada, Ağrı ilinde tüketime sunulan dondurulmuş çiğ etlerdeki *Salmonella* prevalansının ve mevsimsel dağılımının belirlenmesi amaçlanmıştır. Çalışmada analiz edilen 214 dondurulmuş çiğ etin 37'sinden (%17.3) *Salmonella* tespit edilmiştir. Buna göre, 70 tavuk, 74 hindi ve 70 sığır eti örneğinin sırasıyla 19 (%27.1), 17 (%23.0), ve 1'inin (%1.4) *Salmonella* ile kontamine olduğu belirlenmiştir. Analiz edilen et türlerinden *Salmonella* prevalansının en yüksek olduğu tür tavuk eti olarak belirlenmiştir. Çalışmada genel olarak, et türlerinin ilkbahar, yaz, sonbahar ve kış mevsimlerinde sırasıyla %10.7 (6/56), %28.1 (16/57), %12.0 (6/50) ve %17.6 (9/51) düzeyinde *Salmonella* ile kontamine olduğu tespit edilmiştir. Çalışma neticesinde, çiğ kanatlı ve sığır etlerinin *Salmonella*'lar ile yaz aylarında diğer aylara göre daha sıklıkla kontamine olduğu gözlenmiştir. Çalışmada, tavuk ve hindi etlerinin *Salmonella* ile yüksek oranda kontamine olduğu ve çiğ kanatlı etlerinde *Salmonella* varlığının gıda hijyeni açısından önemli bir risk teşkil ettiği ortaya konmuştur. Buna göre, çiğ kanatlı etleri, mutfakta işlenmeleri esnasında gerekli hijyenik koşullar sağlanarak, tüketime hazır gıdaların kontaminasyonları önlenmeli ve iyi pişirildikten sonra tüketilmelidir.

**Anahtar sözcükler:** *Salmonella*, mevsimsel dağılım, tavuk eti, hindi eti, sığır eti.

### Introduction

Meat can be contaminated with pathogenic microorganisms through farm-to-table stages if hygienic precautions are not taken (9). Gastrointestinal flora is a possible source of foodborne pathogens and during slaughtering and processing, raw meats are often contaminated with feces of animals (12).

Mead et al. (15) reported that, pathogens cause 76 million cases of foodborne illnesses, 325.000 hospitalizations, and 5.000 deaths in the USA annually. Among these, 31% of food-related deaths have been caused by *Salmonella* spp. (15). In Italy between 1991 and 1994, approximately 81% of the 1699 food-borne outbreaks were caused by *Salmo-*

*nella* spp. (19). Contaminated raw or undercooked poultry and red meats are particularly important in transmission of foodborne pathogens (20). In a study, prevalence of *Salmonella* ranged from 23.3 to 47.7% in three poultry processing plants in Ankara (18). It was reported that, due to the cross contaminations in slaughtering *Salmonella* prevalence in poultry meat can reach to 50-100% (8).

*Salmonella*, an important foodborne pathogen of human salmonellosis, has been generally associated with foods of animal origin. Beef and poultry meat plays a significant role in transmission of *Salmonella* spp. to humans throughout the food-chain (4, 10, 16, 17) causing several clinical conditions

such as, enteric fever, enterocolitis, and systemic infections (5).

The aims of this study were to find out the prevalence and seasonal distribution of *Salmonella* spp. in frozen raw turkey meat, chicken meat, and beef in Ağrı.

## Material and Method

**Sample collection:** A total of 214 frozen raw meat samples including 74 turkey meat, 70 chicken meat and 70 beef cuts (approximately 2x3 cm cubic parts), produced by national producers, were collected in Ağrı between June 2008 and May 2009. Frozen raw meat samples were transported to the laboratory in an ice bag and analyzed in the same day for the detection of *Salmonella* spp.

**Isolation of *Salmonella* spp.:** ISO 6579 conventional cultivation method was used to determine the presence of *Salmonella* spp. in meat samples (1). Twenty-five grams of meat samples were weighted into sterile bags and enriched with 225 ml Buffered Peptone Water (BPW, Oxoid CM1049, Hampshire, UK) and incubated at 37°C for 24 hours. Afterwards, aliquots of 0.1 ml were transferred to 10 ml of Rappaport-Vasilliadis Broth (RVB, Oxoid CM669), and incubated at 42°C for 24 hours. Following the incubation, broths were streak onto both Brilliant-green Phenol-red Lactose Sucrose Agar (BPLS, Merck 1.07237, Hohenbrunn, Germany) and Xylose Lysine Desoxycholate Agar (XLD, Oxoid CM0469). The plates were then incubated at 37°C for 24-48 hours. Up to five of the typical colonies grown were picked from each medium and inoculated into Triple Sugar Iron Agar (TSIA, Oxoid CM0277), Lysine Iron Agar (LIA, Oxoid CM0381) and Urea Broth Base (Merck 1.08483) supplemented with 40% of urea solution (Oxoid SR0020). The mediums were incubated at 37°C for 24-48 hours. TSIA positive, LIA positive and urease negative colonies were considered as suspected *Salmonella* spp.

The agglutination test was done with *Salmonella* latex test (Oxoid FT0201A). Suspected *Salmonella* colonies were separately mixed with a drop of antiserum on a slide and incubated up to two minutes at room temperature. Agglutination with antiserum was accepted as a positive reaction for *Salmonella* spp.

## Findings

In the study, a total of 214 frozen raw meat samples, including 74 turkey meats, 70 chicken meats and 70 beef were tested for the presence of *Salmonella* spp. As far as *Salmonella* spp. prevalence was concerned, 37 (17.3%) of the 214 meat samples were detected as positive. Out of 70 chicken meat, 74 turkey meat, and 70 beef samples; 19 (27.1%), 17 (23.0%), and 1 (1.4%) were found to be contaminated with *Salmonella* spp., respectively. Chicken meat samples showed the highest prevalence for *Salmonella* spp. among all the other analyzed meat species.

It was found that during the spring, 21.1% of the chicken (4/19), and 13.3% (2/15) of the turkey meat samples; during the summer, 50.0% (8/16) of the chicken, 29.2% (7/24) of the turkey, and 5.9% (1/17) of the beef samples were contaminated with *Salmonella* spp. It was revealed that, 21.1% (4/19), and 11.8% (2/17) of turkey, and chicken meat samples of the autumn were contaminated with *Salmonella* spp., respectively, while in the winter, 5 (27.8%) of the 18 chicken, and 4 (25.0%) of the 16 turkey meat samples were positive for *Salmonella* spp. In general, 10.7% (6/56), 28.1% (16/57), 12.0% (6/50), and 17.6% (9/51) of the meat samples were found to be contaminated with *Salmonella* spp. during the spring, summer, autumn, and winter, respectively (Table 1). These results showed that the prevalence of *Salmonella* spp. was higher in frozen raw poultry meats and beef in the summer.

**Table 1.** Prevalence and seasonal distribution of *Salmonella* spp. in frozen raw meats in Ağrı.

| Date           | Season | Number of Samples |                            |             |                            |          |                            |
|----------------|--------|-------------------|----------------------------|-------------|----------------------------|----------|----------------------------|
|                |        | Chicken meat      |                            | Turkey meat |                            | Beef     |                            |
|                |        | Analyzed          | <i>Salmonella</i> positive | Analyzed    | <i>Salmonella</i> positive | Analyzed | <i>Salmonella</i> positive |
| June 2008      | Summer | 5                 | 2                          | 9           | 3                          | 6        | 1                          |
| July 2008      |        | 5                 | 3                          | 8           | 2                          | 4        | -                          |
| August 2008    |        | 6                 | 3                          | 7           | 2                          | 7        | -                          |
| September 2008 | Autumn | 5                 | -                          | 7           | 1                          | 5        | -                          |
| October 2008   |        | 6                 | 1                          | 8           | 2                          | 5        | -                          |
| November 2008  |        | 6                 | 1                          | 4           | 1                          | 4        | -                          |
| December 2008  | Winter | 7                 | 2                          | 5           | 1                          | 6        | -                          |
| January 2009   |        | 6                 | 2                          | 5           | 1                          | 5        | -                          |
| February 2009  |        | 5                 | 1                          | 6           | 2                          | 6        | -                          |
| March 2009     | Spring | 7                 | 2                          | 4           | -                          | 9        | -                          |
| April 2009     |        | 5                 | 1                          | 5           | 1                          | 7        | -                          |
| May 2009       |        | 7                 | 1                          | 6           | 1                          | 6        | -                          |
| TOTAL          |        | 70                | 19                         | 74          | 17                         | 70       | 1                          |

## Discussion and Conclusion

In the present study, 27.1% (19/70) of the chicken meat, 23.0% (17/74) of the turkey meat, and 1.4% (1/70) of the beef samples were found to be contaminated with *Salmonella* spp. In previous studies, the prevalence of *Salmonella* in poultry meat and beef shows differences in various countries. The prevalence of *Salmonella* in poultry meat was reported between the ranges of 2.6–36.0% (21, 22). Zhao et al. (22) reported the prevalence of *Salmonella* in chicken, and turkey in USA as 4.2%, and 2.6%, respectively, which was lower than the present study. In a study performed in UK, 5.6% of the chicken meats and 5.6% of the turkey meats were contaminated with *Salmonella* spp. (13). During 1997 and 1998, 19.6% of the turkey carcasses were found to be contaminated with *Salmonella* (6). These data showed that, prevalence of *Salmonella* in developed countries is significantly lower than the present study. Similar to the present study, in Canada 30% of the chicken legs were contaminated with *Salmonella* (2). In England, *Salmonella* spp. were identified in 25% (60/241) of whole raw chicken samples (11). This result is in accordance with our study for *Salmonella* prevalence (27.1%) in chicken meat.

In a study performed in Ankara, *Salmonella* spp. were isolated from 3.3% (4/100) of the ground beef samples (7). Eblen et al. (6) found that, 1.2% of the cattle carcasses were contaminated with *Salmonella* in the USA. In another study, the prevalence of *Salmonella* spp. were assessed as 2.4% in raw red meats and 1.3% in beef samples (14). Similar result with the present study, for the presence of *Salmonella* spp. in beef (1.9%) was reported in the USA (22).

The results of the present study showed that, the prevalence of *Salmonella* spp. were higher in the summer as expected, since similar to these findings, the Centers for Disease Control Foodborne Diseases Active Surveillance Network (FoodNet) data indicated that the outbreaks and clusters of food-borne infections peak during the warmest months of the year in the USA (3).

In the study, high contamination levels of chicken and turkey meats with *Salmonella* spp. were detected. The presence of *Salmonella* in raw poultry meat is an important risk for food hygiene. Poultry meat should be prepared under hygienic conditions in the kitchen to avoid cross contaminations to ready to eat foods and should be cooked adequately before consumption.

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