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Research Article

Prevalence of *Salmonella* Serogroups in Chicken Meat

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Abstract: The purpose of this study was to investigate the prevalence of *Salmonella* serogroups in chicken meat. A total of 315 skins from the wing part of chicken carcasses were collected from 8 chicken carcass retailers. *Salmonella* isolation was performed as described in the Bacteriological Analytical Manual of the Food and Drug Administration, Center for Food Safety and Applied Nutrition. *Salmonella enterica* subsp. *enterica* Serovar Enteritidis (*Salmonella* Enteritidis) in Serogroup D was isolated from 27 out of 315 (8.57%) chicken carcass skins from the wing parts. Four out of 45 (8.88%), 3 out of 50 (6.00%), 12 out of 57 (21.05%), 3 out of 9 (33.33%), 2 out of 6 (33.33%) and 3 out of 60 (5.00%) skins from the wing parts of the chicken carcasses from producers A, B, C, D, E and F, respectively, were found to harbor motile *salmonella*e in Serogroup D. *Salmonella* Enteritidis was not isolated from producers G and H, while 30 (78.94%) nontypable *salmonella*e not belonging to serogroups A, B, C or D were isolated from 38 samples from producer H.

Key Words: Prevalence, *Salmonella*, chicken meat

Tavuk Etlerinde *Salmonella* Serogruplarının Prevalansı

Özet: Bu çalışmanın amacı, tavuk etlerinde *Salmonella* serogruplarının prevalansını araştırmaktır. Sekiz şirketten toplam 315 adet tavuk kanadı toplandı. Çalışmada kullanılan *Salmonella* izolasyon metodu Amerika Birleşik Devletleri, Gıda Güvenliği ve Uygulamalı Beslenme Merkezi'nin Gıda ve İlaç Dairesi tarafından yayınlanan Bakteriyolojik Analitik El Kitapçığında tanımlandığı şekilde uygulandı. Üçyüzonbeş adet tavuk karkasının kanat bölgesi derilerinin 27'sinden (% 8,57) Serogrup D'de yer alan *Salmonella enterica* subsp. *Enterica* Serovar Enteritidis (*Salmonella* Enteritidis) izole edildi. A, B, C, D, E ve F şirketlerinden alınan tavuk karkaslarının kanat bölgesi derilerinden sırasıyla, 45 örneğin dördünün (% 8,88), 50 örneğin üçünün (% 6,00), 57 örneğin onikisinin (% 21,05), 9 örneğin üçünün (% 33,33), 6 örneğin ikisinin (% 33,33), 60 örneğin üçünün (% 5,00) Serogrup D'de yer alan *Salmonella* Enteritidis içerdiği bulundu. H şirketinden alınan 38 örneğin 30'unda (% 78,94) A, B, C, D serogruplarına ait olmayan ve tiplendirilemeyen *salmonella*lar belirlendi ve H ve G şirketlerinden Serogrup D'de yer alan *Salmonella* suşlarından herhangi bir izolasyon yapılamadı.

Anahtar Sözcükler: Prevalans, *Salmonella*, tavuk eti

Introduction

The infections caused by *Salmonella* serovars are implicated as important public health problems worldwide (1-3). *Salmonella* serovars can cause a variety of clinical manifestations in humans such as fever, bacteremia, gastroenteritis, local infections, arthritis and osteomyelitis. The vehicles indicated in these infections are mostly *Salmonella* contaminated foods (4-6). The most frequently reported and important source of *Salmonella* contamination is cross-contaminated or undercooked chicken meat (7).

Recently, Carli et al. (8) determined that *Salmonella*–infected flock rates and infection prevalences within the flocks are very high in Turkey. This finding made us think that the high *Salmonella* load might be a potential contamination source in slaughterhouses and in retail chicken carcasses in Turkey.

We aimed to investigate the prevalence of *Salmonella* serogroups in chicken carcasses sold retail in Turkey.

Materials and Methods

A total of 315 skins from the wing part of chicken carcasses were collected from 8 different chicken carcass retailers in Turkey. All of the samples were transported to the laboratory within 1 h of purchase, stored at 4 °C and examined within 1 h.

The *Salmonella* isolation method described in the Bacteriological Analytical Manual of the Food and Drug Administration, Center for Food Safety and Applied Nutrition was performed (9). Briefly, an aseptically weighed 25 g skin sample was minced into small parts, added to 225 ml of sterile lactose broth (Oxoid 098 5385) and blended for 2 min. This homogenate was transferred into a sterile wide-mouth, screw-capped jar and incubated for 60 min at room temperature in a securely capped jar. After this pre-enrichment step, 1 ml from this mixture was transferred into 10 ml of Tetrathionate broth (TTB; Oxoid 235780) and incubated at 35 °C for 24 h. Following primary enrichment, 20 µl from the TTB culture was streaked onto Xylose Lysine Tergitol 4 Agar (XLT4; Difco 0234-17-9) and Brilliant Green Novobiocin Agar (BGN; Difco 0285-17-7) and incubated aerobically at 35 °C for 24 h. *Salmonella* suspected colonies were identified by biotyping and serotyping as indicated (9). A, B, C and D group specific sera were used to determine the serogroups. In order to perform serogrouping the *Salmonella* isolates, *Salmonella* "O" Antiserum Poly A (2534-47-6, Difco), *Salmonella* "O" Antiserum Poly B (2535-47-5, Difco), *Salmonella* "O" Antiserum Factor 1 (2658-47-6, Difco), *Salmonella* "O" Antiserum Factor 4 (2659-47-5, Difco), *Salmonella* "O" Antiserum Factor 5 (2660-47-2, Difco), *Salmonella* "O" Antiserum Factor 9 (2818-47-3, Difco), *Salmonella* "O" Antiserum Factor 12 (2779-47-0, Difco), *Salmonella* "O" Antiserum Factor 14 (2661-47-1, Difco), *Salmonella* "O" Antiserum Group C_1 Factors 6-7 (2949-47-5, Difco) and *Salmonella* "O" Antiserum Group C_2 Factors 6-8 (2950-47-1, Difco) were used. Before serogrouping, motile *salmonella*e were determined by motility test on Sim Medium (0271-01-1, Difco) and then serogrouping was applied to those motile isolates.

Results

In this study, 315 skins from the wing parts of retail broiler chicken carcasses were obtained from 8 major chicken carcass producers in Turkey. Numbers of *Salmonella* isolated from these samples are shown in detail in the Table.

Salmonella Enteritidis in Serogroup D was isolated from 27 out of 315 (8.57%) chicken carcass skins from the wing parts. Four out of 45 (8.88%), 3 out of 50 (6.00%), 12 out of 57 (21.05%), 3 out of 9 (33.33%), 2 out of 6 (33.33%) and 3 out of 60 (5.00%) skins from the wing parts of the chicken carcasses from producers A, B, C, D, E and F, respectively, were found to harbor motile *salmonella*e in Serogroup D. No *Salmonella* Enteritidis was isolated from samples from producers G and H, while 30 (78.94%) nontypable *salmonella*e not belonging to serogrups A, B, C or D were isolated from 38 samples from producer H. The prevalence of *Salmonella* Enteritidis and nontypable *salmonella*e, not belonging to *Salmonella* serogroups A, B, C or D, was 8.57% and 9.52%, respectively.

Table. Numbers of *Salmonella* isolated from chicken skin of the wing parts purchased from 8 producers.

	Producer code	Samples examined	Number of SE* positive samples (%)	Number of NTS** positive samples (%)	Total number of *Salmonella* positive samples (%)
	A	45	4 (8.88)	0 (0.00)	4 (8.88)
	B	50	3 (6.00)	0 (0.00)	3 (6.00)
	C	57	12 (21.05)	0 (0.00)	12 (21.05)
	D	9	3 (33.33)	0 (0.00)	3 (33.33)
	E	6	2 (33.33)	0 (0.00)	2 (33.33)
	F	60	3 (5.00)	0 (0.00)	3 (5.00)
	G	50	0 (0.00)	0 (0.00)	0 (0.00)
	H	38	0 (0.00)	30 (78.94)	30 (78.94)
TOTAL	8	315	27 (8.57)	30 (9.52)	57 (18.09)

* SE, *Salmonella* Enteritidis **NTS, nontypable *Salmonella*

Discussion

Carli et al. (8) determined that *Salmonella*-infected broiler flock rates and infection prevalences within flocks were high in Turkey. Studies in other countries have reported on the prevalence of *Salmonella* in poultry, with contamination percentages ranging from 13.7% to 66% (10-16). In this study, we isolated Serogroup D *Salmonella* and other nontypable *salmonella*e from 7 out of 8 broiler carcass producers at levels of 8.57% and 9.52%, respectively. Our overall isolation percentage is approximately in the range of what has been reported in previous studies. These results indicate widespread contamination of poultry products with *Salmonella* spp., regardless of the producer company, and their potential as a risk factor for human health. Variations observed between the reported *Salmonella* prevalences in previous studies may be due to several factors, including the initial pre-slaughter *Salmonella* load of the birds, sanitation within the slaughterhouse, possible contamination during poultry processing steps, the amount of cross or post-contamination of chicken carcasses by faecal material during or after slaughter, and the sensitivity and specificity of different isolation methods applied to detect *Salmonella* (10,17). Detection of *Salmonella* from chicken meat can only be achieved using a reliable procedure, such as the National Poultry Improvement Plan (NPIP) of the U. S Department of Agriculture (18) at the chicken breeding level or the BAM-FDA-CFSAN at the chicken food processing level (9). We decided to sample the skin from the wing parts of the chicken carcasses to perform proper *Salmonella* isolation, since the neck and the wing parts are where all the water from the carcass accumulates and drips out, and therefore would have a high potential to harbor contaminating flora.

The most prevalent serogroup identified in this study was Serogroup D *Salmonella* covering *Salmonella enterica* subsp. *Enterica* Serovar Enteritidis (*Salmonella* Enteritidis), a result similar to one previously reported from Spain (19). In other countries it has been reported that *Salmonella enterica* subsp. *Enterica* Serovar Bredeney (*Salmonella* Bredeney) belonging to Serogroup B (11) and *Salmonella enterica* subsp. Enterica Serovar Typhimurium (*Salmonella* Typhimurium) belonging to Serogroup B (20) are the predominantly isolated serovars from foods. In Turkey, there are only limited data on the presence and prevalence of *Salmonella* serogroups in poultry (8), while there are no data on *Salmonella* prevalence in chicken meat.

In summary, this study demonstrates the prevalence and the most frequently isolated serogroup of *Salmonella* present in retail chicken carcasses. Continuous up to date monitoring and control methodologies, which should be applied in poultry farms and slaughterhouses and by retailers, for the prevention or reduction/total elimination of this pathogen, where possible, are strongly recommended.

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