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ÖZLEM TURGAY

NUH ÖZKAN

EMEL ÇAKIROĞLU

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Salmonella enteritidis in Quail Eggs

Özlem Turgay ERDOĞRUL

Kahramanmaraş Sütçü İmam University, Agriculture Faculty, Food Science Department, Kahramanmaraş - TURKEY

Nuh ÖZKAN, Emel ÇAKIROĞLU

Kahramanmaraş Sütçü İmam University, Science and Art Faculty, Biology Department, Kahramanmaraş - TURKEY

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Abstract: The presence of *Salmonella enteritidis* was investigated in 123 liquid whole quail eggs. *Salmonella* strains were identified and sero-grouped by coagglutination test and slide agglutination test. Seven (5.69%) of 123 whole quail eggs were in group D1 and were sero-typed as *Salmonella enteritidis*.

It was found that in phage-typing of *Salmonella enteritidis*, three of 7 strains were *Salmonella enteritidis* PT4, two of them were PT1, one of them was PT7, and one of them was indefinite.

Key Words: Quail egg, *Salmonella enteritidis*, phage-typing

Bıldırcın Yumurtasında *Salmonella enteritidis* Varlığı

Özet: Bu çalışmada, 123 bıldırcın yumurtası örneğinde *Salmonella enteritidis* varlığı araştırılmıştır. Koagülasyon ve lam aglütinasyon testleri sonucunda sero guruplandırma yapılmıştır. Yapılan testler sonucunda 123 bıldırcın yumurtasından 7 tanesi (% 5,69) *Salmonella enteritidis* D1 sero grubu olarak saptanmıştır.

Faj tiplendirilmesi sonucunda, toplam 7 suşun 3'ü *Salmonella enteritidis* PT4, 2'si PT1, bir tanesi PT7 olarak tespit edilmiş ve 1 tanesinin de faj tipi belirlenmemiştir.

Anahtar Sözcükler: Bıldırcın yumurtası, *Salmonella enteritidis*, faj tiplendirmesi

Introduction

Eggs and egg products are considered to be the major sources of confirmed *Salmonella* food poisoning. Bacterial penetration of the shell and membranes has been documented when eggs are inoculated solely by placing them onto nest box shavings contaminated with *Salmonella* (1). The food products most commonly identified as vehicles for transmission of *Salmonella* include raw eggs, under processed egg products, cheese, mayonnaise, baby food, meringue and ice cream (2).

Egg-associated salmonellosis is a substantial public health problem. *Salmonellae* is one of the most commonly reported causes of food borne outbreaks in the United States. These organisms have accounted for 28% of outbreaks of known etiology from 1973 to 1987 (3).

Since 1976, Salmonellosis cases caused by *Salmonella enteritidis* have dramatically increased. The proportion of *Salmonella enteritidis* among reported *Salmonella* isolates increased from an estimated 5% in 1976 to 26% in 1994 (4). Many studies have established that *Salmonella*

enteritidis contaminates eggs when the organism is passed from the infected reproductive tissue of hens, rather than the shell, to the contents of contaminated eggs (5,6,7). In a later study, 15% of unpasteurized liquid whole eggs were positive for *Salmonella enteritidis* with no seasonal differences (8). A USDA investigation showed a maximum of 5.3 *Salmonellae*/g while another study did a maximum of 110 *Salmonellae*/g. The two studies combined found that less than 3 *Salmonellae*/g were present in 96% of the positive samples (9).

The aim of this study was to determine the presence of *Salmonella enteritidis* and their phage-typing in liquid whole quail eggs.

Materials and Methods

Quail eggs: 123 quail egg samples were obtained at random from local supermarkets in Kahramanmaraş city. The eggshell surfaces were sterilized with 70% alcohol and the residual alcohol was removed by flaming the

shell. Eggshell membranes were aseptically removed with a peeling action from the inside of the shell.

Culture method for identification and enumeration of *Salmonella*: Both the egg yolk and liquid egg of the quail eggs were pre-enriched in phosphate buffered saline at 37°C for 18-24 h and 1 ml of the pre-enriched culture was then transferred to 9 ml each of Selenite Sistine (SC) broth at 35°C for 18-24 h. After selective enrichment, samples were streaked on to MacConkey Agar (Difco) which was used as the distinctive medium and incubated at 35°C for 18-24 h. *Salmonella*-Shigella Agar (SS Agar Difco) was used as the selective medium and incubated at 37°C for 18-24h. The plates were examined for the presence of suspected *Salmonella* colonies. Typical *Salmonella* colonies were selected and incubated in Lassen's medium, glucose phosphate broth, KCN broth, nutrient gelatin Simmons citrate agar, malonate broth and carbohydrate fermentation broth (10,11). Also gram staining was done to the doubtful colonies determined on MacConkey Agar to be colorless, and translucent and on SS Agar to be translucent.

Pure cultures of gram negative rods were streaked on to MacConkey Agar and were selected and serologically tested using Bacto-*Salmonella* O Antisera set A-I (Difco Lab. Detroit, Michigan), and tested with polyvalent O and then *Salmonella* strains were sero-grouped by co-agglutination and slide agglutination tests. Also lam agglutination tests with group antisera *Salmonella* B, C1, C2, D1 group antisera were used. In addition, sero-types were fixed with type specific antisera (12).

Salmonella enteritidis isolates were sent to the Paris Pasteur Institute and the Berlin Robert Von Ostertag Institute for phage-typing.

Results and Discussion

Salmonella strains were identified and sero-grouped by coagglutination tests and slide agglutination tests. Seven (5.69%) of 123 whole quail eggs were found in group D1 and were sero-typed as *Salmonella enteritidis* and in phage-typing of *Salmonella enteritidis*, three of 7 strains were *Salmonella enteritidis* PT4, two of them

Table 1. *Salmonella enteritidis* and their phage types isolated from Quail Eggs.

Product	Material number	<i>Salmonella enteritidis</i> D1 sero-group (n:7)			
		PT4	PT1	PT7	indefinite
Whole Quail Egg	123	3	2	1	1

were PT1, one was PT7 and another one was indefinite as shown in Table 1.

Even though original populations of *Salmonella enteritidis* in liquid egg are low, there is the potential for these populations to increase to levels capable of causing disease. Temperature abuse of the egg product can lead to higher numbers of organism that may not be completely eliminated by current pasteurization protocols. *Salmonella enteritidis* survived best in 5% NaCl + 5% sucrose egg yolk followed by egg yolk + 10% NaCl, egg yolk and whole egg and, lastly, egg white. The increased resistance of *Salmonella enteritidis* in salted egg yolk products had been documented previously by other scientists (13, 14).

Contamination of individual eggs with *Salmonella enteritidis* is infrequent, and outbreaks are typically associated with food service situations in which eggs are pooled (6). Nevertheless improper storage of ingredients and negligence in preparation could increase the risk of the growth of *Salmonella*. Some main principles are involved in the prevention of outbreaks of food-borne *Salmonella* infections: avoidance of contamination of the food with *Salmonellae* from sources such as diseased human beings and animals and carriers and ingredients carrying the organisms, e.g., contaminated eggs. Care and cleanliness in food handling and preparation are important. Ingredients used in foods should be free of *Salmonellae*, if possible, and the growth of *Salmonella* in foods should be prevented by adequate refrigeration or by other means.

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