



# Contamination of Chicken Meat With *Salmonella* spp Distributed in Mahabad City, Iran

Saman Mahdavi<sup>1\*</sup>, Mahsa Azizi Dehbokri<sup>2</sup>, Saba Hajazimian<sup>3</sup>, Alireza Isazadeh<sup>3,4</sup>

<sup>1</sup>Department of Microbiology, Maragheh Branch, Islamic Azad University, Maragheh, Iran

<sup>2</sup>Department of Food Engineering, Maragheh Branch, Islamic Azad University, Maragheh, Iran

<sup>3</sup>Department of Genetic, Tabriz Branch, Islamic Azad University, Tabriz, Iran

<sup>4</sup>Young Researchers and Elite Club, Maragheh Branch, Islamic Azad University, Maragheh, Iran

## \*Corresponding Author:

Saman Mahdavi,  
Address: Department of  
Microbiology, Maragheh Branch,  
Islamic Azad University, Maragheh,  
Iran  
Tel: +98-9144150454,  
Email:  
S.mahdavi@iau-maragheh.ac.ir

Published Online May 27, 2018

**Keywords:** Chicken meat,  
*Salmonella*, Mahabad



## Abstract

**Background:** Foodborne diseases are one of the fundamental problems in the world. *Salmonella* is one of the most important foodborne bacteria, which is responsible for the prevalence of foodborne diseases in humans.

**Objective:** The aim of this study was to investigate the presence of *Salmonella* in distributed chicken meat in Mahabad city, Iran.

**Materials and Methods:** In this study, 100 samples of chicken meat were selected from Mahabad city and investigated for the presence of *Salmonella*. Each sample was cultured in selenite cystine medium and incubated at 37°C for 24 hours. Then the obtained colonies were cultured in MacConkey agar and *Salmonella*-Shigella agar. Finally, biochemical and antibiogram tests were performed on isolated *Salmonella* samples.

**Results:** Totally, 7 chicken samples (7%) were found to be contaminated with *Salmonella*. All of the isolated *Salmonella* samples were identified as *Salmonella enteritidis*. All of *S. enteritidis* isolates (100%) showed the highest resistance to erythromycin and ampicillin antibiotics. All of the tested isolates (100%) showed sensitivity to gentamicin.

**Conclusion:** Our study showed high prevalence of *Salmonella* in distributed chicken meat in Mahabad city. Therefore, the improvement of health conditions in food preparation centers is highly recommended.

Received October 19, 2017; Revised April 12, 2018; Accepted April 21, 2018

## Background

Foodborne diseases are one of the serious problems in developed and developing countries. Every year, more than 100 million people are afflicted by foodborne and waterborne diseases in the world, especially people with immune system deficiency and malnutrition.<sup>1</sup> Pathogens can survive in the food products, especially in meat, until distribution in the markets.<sup>2</sup> Poultry meat is one of the most popular food products worldwide. Several nutritional factors such as high level of protein, low fat content, and favorable unsaturated fatty acid content contribute to the popularity of poultry meat, of which sensory, dietary, and economic factors are of considerable importance.<sup>3</sup>

There are different types of organisms which are known to cause foodborne infections. One of the most important causes of foodborne diseases is *Salmonella*,<sup>4</sup> which affects humans through the use of contaminated and raw meat.<sup>5</sup> *Salmonella* is usually found in animal source foods including chicken, beef and pork meat, egg and milk. It also spreads through zoonotic transmission.<sup>6</sup> Many studies have reported outbreak of *Salmonella* and its resistance to

antibiotics in chicken meat worldwide.<sup>6-9</sup> The prevalence of *Salmonella* in chicken meat has been reported to be about 6.79% to 97.6%.<sup>10</sup> Some of the *Salmonella* species isolated from chicken meat are resistant to antibiotics and can lead to foodborne diseases. Despite significant improvement in public health, *Salmonella* still remains the most important cause of foodborne diseases worldwide. Moreover, increase in the outbreak of multidrug resistant *Salmonella* species is the major problem in the treatment and prevention of foodborne diseases in humans.

Some food products including chicken meat are distributed traditionally unpackaged in our country, while chicken meat is one of the most popular foodstuff. Therefore, chicken meat plays an important role in transfection of *Salmonella*. Studies have also shown that some of the *Salmonella* serotypes isolated from meat products are antibiotic resistant and lead to many serious infections in humans.<sup>11</sup>

## Objective

The periodic evaluation of *Salmonella* presence in various foods is necessary to control and reduce salmonellosis in

human. Therefore, we aimed to evaluate the presence of *Salmonella* in distributed chicken meat in Mahabad city, Iran.

**Materials and Methods**

**Sample Collection and Preparation**

For this study, we collected 100 samples of chicken meat (thigh and breast, 100 g) from a slaughterhouse in Mahabad city. The collected samples were transported on ice to the Microbiology Laboratory of Maragheh Islamic Azad University, Iran.

**Isolation and Identification of Salmonella**

Twenty-five grams of tissue samples was added to 225 mL of lactose broth medium and incubated at 37°C for 24 hours (Brilliant green stain was added as growth inhibitor of gram-positive bacteria). Then, 1 mL of this medium was added to 9 mL of selenit cysteine and incubated at 37°C for 24 hours. One loop of current medium was transferred to MacConkey agar, *Salmonella* Shigella (SS) agar, and Xylose Lysine Deoxycholate (XLD) agar, separately. Colorless colonies (lactose negative) were considered as suspicious of *Salmonella*. These colonies were cultured in Triple Sugar Iron (TSI) agar, Lysine Iron Agar (LIA), Sulphide Indole Motility (SIM) agar and Urea agar. Furthermore, the reaction of these colonies was assessed in arabinose, raffinose, trehalose, arginine, malonate, ornithine, and salicin media. Finally, *Salmonella* species were identified serologically using polyvalent antiserum (Bahar Afshan Company, Iran).<sup>12</sup>

**Antimicrobial Resistance and Antibiogram**

The sensitivity of isolated *Salmonella* samples to antibiotic was evaluated using disk diffusion method on Mueller-Hinton agar medium (Bahar Afshan Company, Iran) according to the criteria published by the Clinical and Laboratory Standards Institute (CLSI). The used antibiotics were: cephalexin, gentamicin, kanamycin, neomycin, tetracycline, ampicillin, nalidixic acid, cotrimoxazole, and erythromycin.<sup>13</sup>

**Results**

In our study, 7 chicken samples (7%) were contaminated

with *Salmonella*. The serotyping results also showed that *S. enteritidis* was the sole serovar of *Salmonella* in distributed chicken raw meat in Mahabad city.

All of *S. enteritidis* isolates (100%) showed the most antibiotic sensitivity to erythromycin and ampicillin. All of the tested isolates (100%) also showed resistance to gentamicin (Table 1).

**Discussion**

The results of this study showed that 7% of chicken samples were contaminated with *Salmonella* and serotyping results showed that *S. enteritidis* was the sole serovar. Unlike our study, some studies reported high prevalence of *Salmonella* in chicken meat samples in Iran and other countries.<sup>14-16</sup> In a study, Dhaher et al showed that 24.76% of chicken samples were contaminated with *Salmonella* in Iraq.<sup>17</sup> Alali et al also showed that 31.5% of retail chicken meat samples were contaminated with *Salmonella* in Russia.<sup>18</sup> In another study, Todd reported that the prevalence of *Salmonella* in chicken meat was 13.3% in Ethiopia.<sup>19</sup> High prevalence of *Salmonella* were reported by Tibaijuka, as 42% of chicken samples were contaminated with *Salmonella*.<sup>20</sup> The presence of *Salmonella* might be indicative of poor hygiene and a potential danger to consumers.

In the present study, the most frequently isolated serotype was *S. enteritidis*. Like this study, in several studies the most frequently isolated serotype was *S. enteritidis*.<sup>21</sup> For example, Jalili et al reported that *S. enteritidis* was the most frequently isolated serotype (29%) from chicken meat samples in Iran.<sup>21</sup> On the contrary, Molla and Mesfin showed that *S. braenderup* and *S. typhimurium* were the dominant serotypes in Ethiopia.<sup>22</sup> Moreover, Abdellah et al reported that *S. typhimurium* (40.35%) was the dominant serotype between 4 different serotypes isolated from chicken meat and giblets.<sup>23</sup>

In this study, all of *S. enteritidis* isolates showed the highest antibiotic sensitivity to erythromycin and ampicillin. On the other hand, all of the tested isolates showed resistance to gentamicin. Likewise, resistance to mentioned antibiotics was reported in some other studies on chicken meat worldwide.<sup>24,25</sup> Our study showed that some *Salmonella* isolates were resistant to tetracycline

**Table 1.** The Resistance and Sensitivity of Isolated *Salmonella* to Different Sntibiotics

Antibiotics	Dose (µg)	<i>Salmonella enteritidis</i>		
		Sensitive (%)	Resistant (%)	Semi-sensitive (%)
Cotrimoxazole	30	4 (57.1)	3 (42.9)	0 (0%)
Cephalexin	30	8 (85.7)	1 (14.3%)	0 (0%)
Neomycin	10	8 (85.7)	1 (14.3%)	0 (0%)
Tetracycline	30	3 (42.9)	4 (57.1)	0 (0%)
Erythromycin	10	7 (100%)	0 (0%)	0 (0%)
Kanamycin	30	8 (85.7)	1 (14.3%)	0 (0%)
Ampicillin	10	7 (100%)	0 (0%)	0 (0%)
Gentamicin	30	0 (0%)	7 (100%)	0 (0%)
Nalidixic acid	30	4 (57.1)	3 (42.9)	0 (0%)

(57.1), Nalidixic acid (42.9) and cotrimoxazole (42.9). Our results did not corroborate the results of Dallal et al in Iran (nalidixic acid resistance [90.6%] and tetracycline resistance [71.6%]),<sup>25</sup> Dogru et al in Turkey (nalidixic acid resistance [62.5%] and tetracycline resistance [6.2%])<sup>26</sup> and Li et al in China (nalidixic acid resistance [47%] and tetracycline resistance [50%]).<sup>24</sup> Furthermore, a low resistance to neomycin (14.3%), kanamycin (14.3%), and cephalexin (14.3%) was found in our study. These results did not agree with the results of Dallal et al in Iran.<sup>25</sup> Differences in results between various studies may be due to geographical differences, differences in the level of food hygiene, and differences in the preparation of chicken meat.

### Conclusion

Our study showed that 7% of chicken samples were contaminated with *Salmonella*. In this study, we did not find *Salmonella* isolates which were resistant to erythromycin and ampicillin antibiotics. This may be due to the inaccessibility and expensiveness of these antibiotics in Iran, which can reduce its consumption. Therefore, these antibiotics can be used in the treatment of *Salmonella* infections in Iran. However, there is a potential for increased resistance to these antibiotics in the future.

### Authors' Contributions

This article was extracted from the MSc project of MAD where SM supervised this project and suggested the problem; MAD and AI and SH participated in determination of sample points, sample preparation procedure and extraction of essential oil. SM wrote and edited the manuscript. All authors read and approved the final manuscript.

### Ethical Approval

This study does not need to have any ethical approval.

### Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

### Financial Support

No funding was involved.

### Acknowledgments

This paper was adopted from Mahsa Azizi Dehbokri's Msc thesis. We would like to express our appreciation to Dr. Geranmayeh for their kind assistance with this project.

### References

1. Egli T, Koster W, Meile L. Pathogenic microbes in water and food: changes and challenges. *FEMS Microbiol Rev*. 2002;26(2):111-112. doi:10.1111/j.1574-6976.2002.tb00603.x
2. Knudsen GM, Sommer HM, Sorensen ND, Olsen JE, Aabo S. Survival of *Salmonella* on cuts of beef carcasses subjected to dry aging. *J Appl Microbiol*. 2011;111(4):848-854. doi:10.1111/j.1365-2672.2011.05094.x
3. Mulder R. Hygiene during transport, slaughter and processing. *Poultry Meat Science Poultry Science Symposium Series*. Oxford, UK: CABI Publishing; 1999:277-285.
4. Carraminana JJ, Rota C, Agustin I, Herrera A. High prevalence of multiple resistance to antibiotics in *Salmonella serovars* isolated from a poultry slaughterhouse in Spain. *Vet Microbiol*. 2004;104(1-2):133-139. doi:10.1016/j.vetmic.2004.08.010
5. Kimura AC, Reddy V, Marcus R, et al. Chicken consumption is a newly identified risk factor for sporadic *Salmonella enterica* serotype Enteritidis infections in the United States: a case-control study in FoodNet sites. *Clin Infect Dis*. 2004;38 Suppl 3:S244-252. doi:10.1086/381576
6. Alvarez-Fernandez E, Alonso-Calleja C, Garcia-Fernandez C, Capita R. Prevalence and antimicrobial resistance of *Salmonella* serotypes isolated from poultry in Spain: comparison between 1993 and 2006. *Int J Food Microbiol*. 2012;153(3):281-287. doi:10.1016/j.ijfoodmicro.2011.11.011
7. Wang H, Ye K, Wei X, Cao J, Xu X, Zhou G. Occurrence, antimicrobial resistance and biofilm formation of *Salmonella* isolates from a chicken slaughter plant in China. *Food Control*. 2013;33(2):378-384. doi:10.1016/j.foodcont.2013.03.030
8. Yildirim Y, Gonulalan Z, Pamuk S, Ertas N. Incidence and antibiotic resistance of *Salmonella* spp. on raw chicken carcasses. *Food Res Int*. 2011;44(3):725-728. doi:10.1016/j.foodres.2010.12.040
9. Maka L, Mackiw E, Scieczynska H, Pawlowska K, Popowska M. Antimicrobial susceptibility of *Salmonella* strains isolated from retail meat products in Poland between 2008 and 2012. *Food Control*. 2014;36(1):199-204. doi:10.1016/j.foodcont.2013.08.025
10. Ramya P, Madhavarao T, Rao LV. Study on the incidence of *Salmonella enteritidis* in poultry and meat samples by cultural and PCR methods. *Vet World*. 2012;5(9):541-545. doi:10.5455/vetworld.2012.541-545
11. Chiu LH, Chiu CH, Horn YM, et al. Characterization of 13 multi-drug resistant *Salmonella* serovars from different broiler chickens associated with those of human isolates. *BMC Microbiol*. 2010;10:86. doi:10.1186/1471-2180-10-86
12. Mallinson ET, Snoeyenbas GH. Salmonellosis. In: Purchase HG, Arp HL, Domermth HC, eds. *A laboratory manual for the isolation and identification of avian pathogens*. 3rd ed. Kendall Hunt Publishing, Iowa, USA: American Association of Avian Pathologists; 1989:3-11.
13. Bauer AW, Kirby WM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disk method. *Am J Clin Pathol*. 1966;45(4):493-496.
14. Soltan Dallal MM, Sharifi Yazdi MK, Mirzaei N, Kalantar E. Prevalence of *Salmonella* spp. in packed and unpacked red meat and chicken in south of Tehran. *Jundishapur J Microbiol*. 2014;7(4):e9254. doi:10.5812/jjm.9254
15. Kaushik P, Anjay, Kumari S, Bharti SK, Dayal S. Isolation and prevalence of *Salmonella* from chicken meat and cattle milk collected from local markets of Patna, India. *Vet World*. 2014;7(1):62-65. doi:10.14202/vetworld.2014.62-65
16. Sodagari HR, Mashak Z, Ghadimianazar A. Prevalence and antimicrobial resistance of *Salmonella* serotypes isolated from retail chicken meat and giblets in Iran. *J Infect Dev Ctries*. 2015;9(5):463-469. doi:10.3855/jidc.5945
17. Dhaher FH, Awni DH, Mahmood NR, Jamil MM, Rasheed HS. Isolation and diagnosis of *Salmonella* in animal origin food, import feed in Baghdad local markets and local poultry farms. *Iraq Acad Sci J*. 2011;3(5):1-19.
18. Alali WQ, Gaydashov R, Petrova E, et al. Prevalence of *Salmonella* on retail chicken meat in Russian Federation. *J Food Prot*. 2012;75(8):1469-1473. doi:10.4315/0362-028x.jfp-12-080
19. Todd EC. *Articles-Foodborne and Waterborne Disease in Developing Countries-Africa and the Middle East*. Dairy Food

- & Environmental Sanitation. 2001;21:110-122.
20. Tibaijuka J. A cross-sectional study of *Salmonella* in chicken meat and offal's in Addis Ababa, Ethiopia [Thesis]. Addis Ababa University and Free University Berlin; 2001.
  21. Jalali M, Abedi D, Pourbakhsh SA, Ghokasin K. Prevalence of *Salmonella* spp. in raw and cooked foods in Isfahan-Iran. *J Food Saf.* 2008;28(3):442-452. doi:10.1111/j.1745-4565.2008.00122.x
  22. Molla B, Mesfin A. A survey of *Salmonella* contamination in chicken carcass and giblets in Central Ethiopia. *Rev Med Vet.* 2003;154(4):267-270.
  23. Abdellah C, Fouzia RF, Abdelkader C, Rachida SB, Mouloud Z. Prevalence and anti-microbial susceptibility of *Salmonella* isolates from chicken carcasses and giblets in Mekns, Morocco. *African j microbiol Res.* 2009;3:215-9.
  24. Li R, Lai J, Wang Y, et al. Prevalence and characterization of *Salmonella* species isolated from pigs, ducks and chickens in Sichuan province, China. *Int J Food Microbiol.* 2013;163(1):14-18. doi:10.1016/j.ijfoodmicro.2013.01.020
  25. Soltan Dallal MM, Doyle MP, Rezadehbashi M, et al. Prevalence and antimicrobial resistance profiles of *Salmonella* serotypes, *Campylobacter* and *Yersinia* spp. isolated from retail chicken and beef, Tehran, Iran. *Food Control.* 2010;21(4):388-392. doi:10.1016/j.foodcont.2009.06.001
  26. Kasimoglu Dogru A, Ayaz ND, Gencay YE. Serotype identification and antimicrobial resistance profiles of *Salmonella* spp. isolated from chicken carcasses. *Trop Anim Health Prod.* 2010;42(5):893-897. doi:10.1007/s11250-009-9504-7