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## Occurrence of *Salmonella* in Chicken Carcasses and Giblets in Meknès-Morocco

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**Abstract:** A study was conducted to estimate the occurrence and distribution of *Salmonella* in raw chicken meat and giblets (liver and gizzard) on the Moroccan market. From November 2005 to November 2006, a total of 576 samples were collected from retailers. Of these, 144 samples were from popular market, 144 from artisanal slaughterhouses, 144 from poulterers' shops and 144 from a supermarket at Meknes (centre-south Morocco). Of the total 576 samples examined, *Salmonella* was detected in 57 (9.90%) of the samples analyzed. Among the chicken samples examined high proportion of gizzard (13.88 %), liver (11.11 %), leg (8.33 %) and breast (6.25 %) were contaminated with *Salmonella*. In summary 30 (20.83 %) of the popular market samples, 24 (16.66 %) of the traditional slaughterhouses samples and 3 (2.08%) of the poulterers' shops were positive for one or more *Salmonella*. Out of the total 57 *Salmonella* isolates, 4 different serotypes were identified of which *S. Typhimurium* (40.35%) was the most frequent followed by *S. Newport* (26.31%), *S. Montevideo* (17.54 %) and *S. Heidelberg* (15.78 %). Results of the present study indicated that there was a high level of *Salmonella* contamination of chicken meat and giblets in popular market and artisanal slaughterhouses, which could be considered as one of the major potential source of human salmonellosis in Morocco.

**Key words:** *Salmonella*, chicken, retail outlets, Meknès, Morocco

### Introduction

In recent years, food borne infections and intoxications have assumed significance as a health hazard. Epidemiological reports suggest that poultry meat is still the primary cause of human food poisoning (Mulder, 1999). Poultry meat is more popular in the consumer market because of advantages such as easy digestibility and acceptance by the majority of people (Yashoda *et al.*, 2001). However, the presence of pathogenic and spoilage microorganisms in poultry meat and its by-products remains a significant concern for suppliers, consumers and public health officials worldwide. Infections with *Salmonella* are one of the most common causes of gastroenteritis worldwide, poultry and poultry products are usually incriminated in outbreaks of human salmonellosis. Bacterial contamination of these foods depends on the bacterial level of the poultry carcasses used as the raw product, the hygienic practices during manipulation and on the time and temperature of storage (El-Leithy and Rashad, 1989).

To satisfy the requirements of consumers in protein animal, the production of poultry meat shows an upward trend in Morocco. However, the control and inspection

during production, storage and distribution are generally rare. Therefore, it is important to prevent the hazards and to provide a safe and wholesome product for human consumption (Singh *et al.*, 1984). The aim of this study was to determine the prevalence of *Salmonella* on chicken carcasses obtained from retail outlets in Meknès, Morocco.

### Materials and Methods

**Samples:** Between November 2005 and November 2006, a total of 576 samples (included 144 breast, 144 legs, 144 gizzards and 144 livers) were collected every ten days from retail outlets in Meknès. Of these, 144 were from popular market, 144 from artisanal slaughterhouses, 144 from poulterers' shops and 144 from a supermarket at Meknes, Morocco. Each sample was placed in a separate sterile plastic bag. Samples were transported to the laboratory immediately after collection in an ice chest and microbiological analysis was carried out immediately.

**Isolation and identification of salmonella:** Twenty-five grams of each sample were put into a stomacher bag

containing 225 ml buffered peptone water (AES Laboratory, Combourg, France) and homogenized using a stomacher (Colworth 400, London). The homogenate was incubated at 37°C for 16 to 20 hours. Two milliliters and 0.1 ml of the pre-enrichment were then respectively transferred in 20ml of selenite cystine broth (Biorad/356-4074/Biorad/Marnes la coquette / France) and 10ml of Rappaport–Vassiliadis broth (Biorad/356-4324/Biorad/Marnes la coquette/France), and incubated for 18–24 h at 37°C (Selenite Cystine) and at 42°C (Rappaport Vassiliadis). Afterwards, one *Salmonella*-Shigella (SS) agar plates per tube was inoculated and incubated at 37°C for 18–24 h. Presumptive *Salmonella* colonies were confirmed by biochemical assays on Kligler Hajna medium, ONPG medium and lysine decarboxylase, and then serotype by slide agglutination test using *Salmonella* polyvalent O and H antisera (Diagnostic Pasteur, Paris, France).

### Results and Discussion

Of the total of 576 samples examined, 9.90% (57/576) were contaminated with *Salmonella* (Table 1). The incidence of *Salmonella* in chicken products obtained by other authors varied between 0 and 100% (Cox and Bayley, 1987; Bryan and Doyle, 1995; Waldroup, 1996). The level of *Salmonella* contamination of chicken samples similar to ours (7.9%) was found by Train *et al.* (2004) in chicken carcasses in Vietnam. However, the contamination level higher than ours (32%) was found by Cardinale *et al.* (2003) in chicken carcasses from retail shops in Dakar. Out of the total 144 samples (n = 576) analyzed from popular market, 30 (20.83%) proved to be *Salmonella* positive whereas from 144 samples obtained from traditional slaughterhouses 24 (16.66 %) contained *Salmonella*. A low level of *Salmonella* contamination was found in samples obtained from poulterers' shops 3 (2.08%). However, *Salmonella* was not detected in any of the samples purchased from supermarket. This difference in the level of contamination is due to the inappropriate working conditions in the artisanal sector. In popular market and artisanal slaughterhouses, slaughtering and sale of chicken meat are done in the same place, which provokes the cross-contamination of the carcasses with *Salmonella*.

In the present study, contamination rates of chicken parts (12.50%) were higher than those of chicken carcasses (7.29%). This was in agreement with the findings of Jerngklinchan *et al.* (1994). A high level of *Salmonella* contamination was found in chicken gizzard (13.88 %) and liver (11.11%), followed by legs (8.33 %)

Table 1: *Salmonella* isolated from retail outlets

Sample	Number of samples		
	Examined	Positive	%
Popular market	144	30	20.83
Artisanal slaughterhouses	144	24	16.66
Poulterers' shops	144	3	2.08
Supermarket	144	0	0

Table 2: *Salmonella* isolated from chicken meat and giblets

Sample	Number of samples		
	Examined	Positive	%
Breast	144	9	6.25
Legs	144	12	8.33
Liver	144	16	11.11
Gizzard	144	20	13.88

and breast (6.25 %) (Table 2).

Out of the total 57 *Salmonella* isolates, 4 different serotypes were identified of which *S. Typhimurium* (40.35%) was the most frequent followed by *S. Newport* (26.31%). *S. Montevideo* (17.54 %) and *S. Heidelberg* (15.78 %).

As shown in Table 3, *S. Montevideo* and *S. Heidelberg* were detected only from samples taken at popular market and at traditional slaughterhouses. *S. Typhimurium* *S. Newport* and *S. Heidelberg* were isolated from all sample types (legs, breast, gizzard and liver). On the other hand, *S. Montevideo* was not detected from breast samples. Previously other studies have reported some of these serotypes in poultry meat and poultry products (Carraminana *et al.*, 1979; Molla *et al.*, 1999; Uyttendaele *et al.*, 1998). It should be noted that the presence and distribution of *Salmonella* serotypes could vary from region to region (Dominguez *et al.*, 2002; Uyttendaele *et al.*, 1998). It should also be mentioned that isolation rates depend upon the country where the study was carried out, the sampling plan and the detection limit of the methodology (Roberts, 1982; Uyttendaele *et al.*, 1998).

The isolation of invasive *Salmonella* serotypes such as *S. Typhimurium* and other pathogenic *salmonellas* in our study indicate the public health significance of these serovars as contaminated chicken meat and meat products may pose health hazards. This risk may further be higher if chicken meat or giblets are consumed undercooked or cross-contamination in the kitchen with *Salmonella* during meal preparation (Scott, 1996; Uyttendaele *et al.*, 1998).

The high level of contamination of chicken meat and giblets with *Salmonella* observed in our study indicates the need for an improvement in the microbiological quality of retail chicken. There is also a need for a comprehensive epidemiological study and control of

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Table 3: Distribution of *Salmonella* serotypes in chicken meat and giblets

Serotype	Number of positive samples				Total	%
	Breast	Legs	Liver	Gizzard		
<i>S. Typhimurium</i>	4	6	7	6	23	40.35
<i>S. Newport</i>	2	3	4	6	15	26.31
<i>S. Montevideo</i>	0	2	3	5	10	17.54
<i>S. Heidelberg</i>	3	1	2	3	9	15.78
Total	9	12	16	20	57	100

*Salmonella* contamination at various levels of chicken production and retail outlets in Morocco.

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### References

Bryan, F.L. and M.P. Doyle, 1995. Health risks and consequences of *Salmonella* and *Campylobacter jejuni* in raw poultry. *J. Food Prot.*, 58: 326-344.

Cardinale, E., J.D. Perrier Gros-Claude, F. Tall, M. Cissé, E.F. Guèye and G. Salvat, 2003. Prevalence of *Salmonella* and *Campylobacter* in Retail Chicken Carcasses in Senegal, *Élev. Méd. Vét. Pays trop.*, 56: 13-16.

Carraminana, J.J., J. Yanguelle, D. Banco, C. Rota, A.I. Agustin, A. Arino and A. Herrera, 1997. *Salmonella* incidence and distribution of serotypes throughout processing in a Spanish poultry slaughterhouse. *J. Food Prot.*, 60: 1312-1317.

Cox, N.A. and J.S. Bayley, 1987. Pathogens associated with processed poultry. In: Cunningham, F.E., Cox, N.A. (Eds.), *Microbiology of Poultry Meat Products*. Academic Press, London, pp: 293-310.

Dominguez, C., I. Gomenz and J. Zumalacarregui, 2002. Prevalence of *Salmonella* and *Campylobacter* in retail chicken meat in Spain. *Int. J. Food Microbiol.*, 72: 165-168.

EI-Leithy, M.A. and F.M. Rashad, 1989. Bacteriological studies on ground meat and its products. *Archiv für Lebensmittelhygiene*, 40: 58-61.

Jerngklinchan, J., C. Koowatananukul, K. Daengprom and K. Saitanu, 1994. Occurrence of *salmonellae* in raw broilers and their products in Thailand. *J. Food Prot.*, 57: 808-810.

Molla, B., J. Kleer and J.H. Sinell, 1999. Occurrence, distribution and level of *Salmonella* in selected food items in Addis Ababa (Ethiopia). *Fleischwirtsch. Int.*, 4: 37-39.

Mulder, R.W., 1999. Hygiene during transport, slaughter and processing. In: *Poultry Meat Science. Poultry Science Symposium Series*. Richardson and Mead (ed.). CABI Publishing, 25: 277-285.

Roberts, D., 1982. Bacteria of public health significance. In: Brown, M.H. (Ed.), *Meat Microbiology*. Applied Science Publishers, London, pp: 319-386.

Scott, E., 1996. Foodborne diseases and other hygiene issues in the home. *J. Appl. Bacteriol.*, 80: 5-9.

Singh, R.D., L.N. Mandal and J.N. Pandey, 1984. Isolation of aerobic microorganisms from poultry meat at central poultry farm and retail shop. *Patna. Poult. Guide*, 21: 71-74.

Train, T.F., L.T.L. Khai, T.T. Nguyen, M. Akita, N. Ogasawara, D. Shinoda and H. Hayashidani, 2004. Prevalence of salmonella spp. in pigs, Chickens and Ducks in the Mekong Delta, Vietnam. *J. Vet. Med. Sci.*, 66: 1011-1014.

Uyttendaele, M.R., J.M. Debevere, R.M. Lips and K.D. Neyts, 1998. Prevalence of *Salmonella* in poultry carcass and their products in Belgium. *Int. J. Food Microbiol.*, 40: 1-8.

Waldroup, A.L., 1996. Contamination of raw poultry whit pathogens. *World Poult. Sci. J.*, 52: 7-25.

Yashoda, K.P., N.M. Sachindra, P.Z. Sakhare and D.N. Rao, 2001. Microbiological quality of broiler chicken carcasses processed hygienically in a small scale poultry processing unit. *J. Food Quality*, 24: 249-259.