Antibiotic sensitivity of Salmonella species isolated from chicken meat products

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A B S T R A C T

A total of 120 random samples of fully and half cooked chicken meat products (60 of each) were collected from different supermarkets at El- Dakahlyia , El-Kalyobia and El-Gharbia governorates for isolation of Salmonellae and detection of their antimicrobial sensitivity. The obtained results indicated that Salmonellae were isolated from the examined samples of chicken nuggets , chicken hot wings, chicken shawerma (half cooked), chicken luncheon ,chicken frankfurter and chicken shawerma (fully cooked) with percentages of 25%, 25%, 30%, 0%, 15% and 35%, respectively. Moreover, the isolated Salmonellae could be serologically identified as *S. typhimurium, S. anatum, S. enteritidis, S. kentucky, S. muenster* and *S. virchow.* Moreover, Salmonellae appeared resistant to Nalidixic acid (100%). In contrast, Gentamycin had the basic effect on viability of Salmonellae followed by Kanamycin and Norfloxacin.

Keywords: Salmonella, antibiotic, chicken hot wings.

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1. INTRODUCTION

The world-wide increase of foodborne infections with antibiotic resistant pathogens is of growing concern and designated by WHO as an emerging public health problem (Much et al., 2007). *Salmonella* is an important pathogen in the food industry and has been frequently identified as the etiological agent of food borne outbreaks (Siqueira et al., 2003). It constitutes a major public health burden and represents a significant cost in many countries. Millions of human cases are reported worldwide every year and the disease results in thousands of deaths (Mead et al., 1999). Since the beginning of the 1990s, strains of *Salmonella* which are resistant to a range of antimicrobials, including first-choice agents for the treatment of humans, have emerged and they are threatening to become a serious public health problem (Kimura et al., 2005). The increase isolation of single or multiple resistant *Salmonella* from human infections is due to abundant use of antimicrobial agents in food production (Zhao et al., 2006). Therefore, the objective of the current study was to determine the level of Salmonella species from chicken meat products and their antibiotic resistance.

2. MATERIAL AND METHODS

2.1. Collection of Samples:

A grand total of 120 random samples of poultry meat products classified into 60 samples of half cooked chicken meat products (20 each of chicken nuggets, chicken hot wings and frozen chicken shawerma) and 60 samples of fully cooked chicken meat products (20 each of chicken luncheon, chicken frankfurter and chicken shawerma) were collected from different supermarkets at El- Dakahlyia, El-Kalyobia and El-Gharbia governorates for isolation of Salmonella and their antimicrobial sensitivity.

2.2. Preparation of Samples:

The samples were prepared according to the technique recommended by APHA (1992)

as follows: twenty five grams of the examined chicken products samples were transferred to a septic blender jar and 225 ml of 0.1 % sterile buffered peptone water were aseptically added to the content of jar. Each sample was then homogenized in the blender at 2000 r.p.m for 1-2 minutes to provide a homogenate,

2.3. Isolation and identification of Salmonellae (ISO ,2002):

It was carried out by using Rappaports Vassilidis as enrichment broth and XLD as selective plating agar.

2.4. Testing for antimicrobial susceptibility:

Antimicrobial susceptibility was tested by the single diffusion method according to Srivani (2001). Sensitivity discs with variable concentrations were used to determine the susceptibility of the isolated *Salmonella* species (Difco Laboratories and BioMerieux, France). Therefore, the antimicrobial susceptibility testing was applied according to the guidelines stipulated by National Committee for Clinical Laboratory Standards "NCCLS" (2001). Accordingly, the antimicrobial discs and their concentrations as well as the diameters of the zones of inhibition for the tested *Salmonella* strains were demonstrated.

3. RESULTS

Results indicated that Salmonellae were isolated from 25%, 25%, 30%, 15% and 35% of the examined samples of chicken nuggets, chicken hot wings, half cooked chicken shawerma, chicken frankfurter and fully cooked chicken shawerma, respectively. *Salmonellae* could be identified serologically as *S. anatum* (0.83%), *S. enteritidis* (5.83%), *S. kentucky* (4.17%), *S. muenster* (1.67%), *S. typhimurium* (7.5%) and *S.virchow* (1.67%). While, *Salmonella* serotype isolated from the examined samples of chicken frankfurter was *S. anatum* at 5%, but *S. enteritidis* was recorded in 5%, 10%, 10% and 10% of the examined samples of chicken nuggets, chicken hot wings, half cooked chicken shawerma and fully cooked chicken shawerma. While, *S. kentucky* was recorded in 5%, 5%, 10% and 5% of the same examined samples, respectively as well as, *S. muenster* was recorded in 5% of both examined samples of chicken nuggets and half cooked chicken shawerma also, *S. typhimurium* was recorded in 10%, 5% and 20% of the examined samples of chicken nuggets, chicken hot wings, chicken frankfurter and fully cooked chicken shawerma and *S. Virchow* was recorded in 5% of both examined samples of half cooked chicken shawerma and chicken frankfurter (table 1 and 2). Salmonella species were highly resistant to Nalidixic acid (100%), In contrast, Gentamycin had the basic effect on viability of *Salmonella* species followed by Kanamycin and Norfloxacin. From all the identified *Salmonella* species, one strain of S. *enteritidis* was multi-resistant to all tested antibiotics. However, one strain of *S. anatum* was resistant to Nalidixic acid. It is of a great concern to mention that *S. typhimurium* strains were highly sensitive to Kanamycin, Norfloxacin, Chloramphenicol and Ciprofloxacin. While, such strais was resistant to Nalidixic acid, Erythromycin, Amoxicillin and Penicillin. On the other hand, *S. enteritidis* strains were highly sensitive to Gentamycin, Kanamycin and Norfloxacin. While such strains were resistant to Nalidixic acid, Erythromycin and Amoxicillin. Also, *S. kentucky* and *S. muenster* strains were highly sensitive to Ciprofloxacin, Neomycin and Streptomycin. While such strains were resistant to Nalidixic acid, Erythromycin and Amoxicillin. As well as, *S. virchow* were resistant to Nalidixic acid, Erythromycin and Amoxicillin. While, S. *anatum* was resistant to Nalidixic acid as in tables (3 and 4).

Table (1) Incidence and serotyping of Salmonella species isolated from the examined samples of half cooked chicken meat products (n=20).

	Chicken nuggets		Chicken hot wings		Chicken shawerma (half cooked)	
	No.	%	No.	%	No.	%
S. anatum	-	-	-	-	-	-
S. enteritidis	1	5	2	10	2	10
S. kentucky	1	5	1	5	2	10
S. muenster	1	5	-	-	1	5
S. typhimurium	2	10	2	10	-	-
S.virchow	-	-	-	-	1	5
Total	5	25	5	25	6	30

Table (2) Incidence and serotyping of Salmonella species isolated from the examined samples of fully cooked chicken meat products (n = 20).

	Chicken nuggets		Chicken hot wings		Chicken shawerma (fully cooked)	
	No.	%	No.	%	No.	%
S. anatum	-	-	1	5	-	-
S. enteritidis	-	-	-	-	2	10
S. kentucky	-	-	-	-	1	5
S. typhimurium	-	-	1	5	4	20
S.virchow	-	-	1	5	-	-
Total	-	-	3	15	7	35

Table (3): Percentages of Antimicrobial susceptibility of Salmonella species isolated from the examined samples of heat treated chicken meat products (n= 26).

	Susceptible		Intermediate		Resistant	
	No.	%	No.	%	No.	%
Nalidixic acid (NA)	-	-	-	-	26	100
Erythromycin (E)	-	-	1	3.8	25	96.2
Amoxicillin (AMX)	1	3.8	2	7.7	23	88.5
Penicillin (P)	1	3.8	3	11.5	22	84.6
Sulphamethoxazol (SXT)	2	7.7	4	15.4	20	76.9
Ampicillin (AM)	3	11.5	3	11.5	20	76.9
Oxytetracycline (T)	5	19.2	2	7.7	19	73.1
Streptomycin (S)	3	11.5	5	19.2	18	69.2
Neomycin (N)	7	26.9	4	15.4	15	57.7
Ciprofloxacin (CP)	9	34.6	8	30.8	9	34.6
Chloramphenicol (C)	11	42.3	5	19.2	7	26.9
Norfloxacin (NOR)	14	53.8	7	26.9	5	19.2
Kanamycin (K)	18	69.2	6	23.1	2	7.7
Gentamycin (G)	23	88.5	2	7.7	1	3.8

4. DISCUSSION

Salmonella organisms were previously isolated from chicken meat products by Ahmed (2004), Elhoti (2006) and Sobieh (2014). The number of human cases of salmonellosis increased due to serious hygienic deficiency in food technology during processing, production and storage of food, as well as due to poor hygiene of working personal (Koutikoysk and Kasijanenka, 1991). Salmonella is an important pathogen in the food industry and has been frequently identified as the etiological agent of food borne outbreaks (Siqueira et al., 2003). Also, It is estimated that 93.8

Table (4): Antimicrobial resistance profile of Salmonella species isolated from the examined samples of heat treated chicken meat products (n= 26).

Salmonella serovar	Antimicrobial resistance profile	MAR index
S.Typhimurium	NA, E, AMX, P, SXT, AM, T, S, N, CP, C, NOR, K	0.928
S. Typhimurium	NA, E, AMX, P, SXT, AM, T, S, N, CP, C, NOR	0.857
S. Typhimurium	NA, E, AMX, P, SXT, AM, T, S, N, CP, C	0.786
S. Typhimurium	NA, E, AMX, P, SXT, AM, T, S, N	0.643
S. Typhimurium	NA, E, AMX, P, SXT, AM, T, S, N	0.643
S. Typhimurium	NA, E, AMX, P, SXT, AM, T, S	0.571
S. Typhimurium	NA, E, AMX, P, SXT, AM, T	0.500
S. Typhimurium	NA, E, AMX, P	0.286
S. Typhimurium	NA, E	0.143
S. Enteritidis	NA, E, AMX, P, SXT, AM, T, S, N, CP, C, NOR, K, G	1
S. Enteritidis	NA, E, AMX, P, SXT, AM, T, S, N, CP, C, NOR	0.857
S. Enteritidis	NA, E, AMX, P, SXT, AM, T, S, N, CP, C, NOR	0.857
S. Enteritidis	NA, E, AMX, P, SXT, AM, T, S, N, CP, C	0.786
S. Enteritidis	NA, E, AMX, P, SXT, AM, T, S, N	0.643
S. Enteritidis	NA, E, AMX, P, SXT, AM, T, S	0.571
S. Enteritidis	NA, E, AMX, P, SXT, AM	0.429
S. Kentucky	NA, E, AMX, P, SXT, AM, T, S, N, CP	0.714
S. Kentucky	NA, E, AMX, P, SXT, AM, T, S, N	0.643
S. Kentucky	NA, E, AMX, P, SXT, AM, T, S, N	0.643
S. Kentucky	NA, E, AMX, P, SXT, AM, T, S	0.571
S. Kentucky	NA, E, AMX, P	0.286
S. Muenster	NA, E, AMX, P, SXT, AM, T, S, N, CP	0.714
S. Muenster	NA, E, AMX, P, SXT, AM, T, S, N	0.643
S. Virchow	NA, E, AMX	0.214
S. Virchow	NA, E	0.143
S. Anatum	NA	0.071

E: Erythromycin	NA: Nalidixic acid	P: Penicillin	AMX: Amoxicillin
T: Oxytetracycline	SXT: Sulphamethoxazol	AM: Ampicillin	S: Streptomycin
N: Neomycin	C: Chloramphenicol	NOR: Norfloxacin	CP: Ciprofloxacin
K: Kanamycin	G: Gentamycin		

million worldwide cases of acute gastroenteritis due to salmonella species causing 155,000 deaths annually (Majowicz et al., 2010). The present results come in accordance with Chen et al. (2004), Bouchrif et al. (2009), Dione et al. (2009) and Akbar and Anal (2013) for Tetracycline and Streptomycin. In addition, these results were nearly similar to Chao et al. (2007) for Amoxicillin and Aslama et al. (2012) for Ciprofloxacin and Streptomycin. While, these results disagree with those reported by Ellerbroek et al. (2010) for Ciprofloxacin and Aslama et al. (2012) for Nalidixic acid. Antibiotics have been successfully used in poultry and farming for different purposes such as growth promotion, prophylaxis, or therapeutics. However, their indiscriminate use caused an increased bacterial resistance, mainly in *Salmonella* strains (Abdellah et al., 2009). In addition, the emergence of antimicrobial resistant *Salmonella* is associated with the use of antibiotics in animals raised for food; resistant bacteria

can be transmitted to humans through foods, particularly those of animal origin (Nygård et al., 2008). The development of antimicrobial resistance in zoonotic bacteria (as *Salmonella*) constitutes a public health risk, as it may potentially affect the efficacy of drug treatment in humans (Abdellah et al., 2009). Finally, the majority of isolated Salmonella strain isolated from the examined samples either half cooked or fully cooked chicken meat product had multiple antibiotic resistance.

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