Journal of Advanced Veterinary Research

https://advetresearch.com/index.php/avr/index

Rate of *Salmonellae* and *Bacillus cereus* in some Retailed cut-up Chicken and Poultry Meat Products

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ARTICLE INFO

Original Research

Received:
11 April 2019

Accepted:
30 April 2019

Keywords:

Bacillus cereus, Chicken, *Salmonella* spp., Poultry products

ABSTRACT

Food poisoning illness outbreaks brought about by pathogenic bacteria and/ or their toxins are yet worry of both shopper and food industry. Accordingly, one hundred and seventy-five samples were collected randomly, samples included frozen chicken breast, frozen chicken thigh, chicken luncheon, chicken burger and chicken frankfurter (35 of each), collected from different supermarkets in Cairo and New Valley governorate for incidence of *Salmonella* species and *Bacillus cereus*. *Salmonella typhimurium* was detected in percentage of 5.7%, and 2.9% in chicken breast and chicken thigh respectively, while *Salmonella enteritidis* was isolated from chicken breast and chicken thigh with the same percentage (2.9%), but *Salmonellae* as a whole failed to be detected in chicken burger, luncheon and frankfurter. On the other hand, *Bacillus cereus* was isolated in a percentage of 8.6 %, 8.6%, 17.1%, 14.3% and 11.4%, from chicken breast, thigh, burger, luncheon and frankfurter, respectively. Thus, it is important to control contamination of chicken meat in abattoirs with *Salmonellae* and *Bacillus cereus* to reduce the incidence of food borne infection to humans.

J. Adv. Vet. Res. (2019), 9 (2),76-80

Introduction

Microbial tainting of poultry bodies and their cuts are a characteristic after effect of various techniques important to create retail items from living feathered creatures. Defilement of poultry meat items might be happened all through introductory preparing, bundling and capacity until the items are adequately cooked and expended. Substantial bacterial burdens enter the handling activities with the living winged creatures and these microbes can be dispersed all through the plant amid preparing (Zhang *et al*., 2001; Kim *et al*., 2012a).

Poultry has been distinguished as an essential supply for *Salmonella* serovars, which are harbored in the skin and quills just as in the gastrointestinal tract, thus, *Salmonella* can persevere on definite crude items. Ailment can result when these items are dealt without clean practices, not legitimately cooked, as well as exposed to temperature misuse (Zhang *et al*., 2001).

It is viewed as that the nearness of *Salmonella* species in chickens makes it risky for human utilization (Bjerrum *et al*., 2005; Agunos, 2007). The innovative techniques for getting chicken corpses and cuts for utilization are likewise potential dangers of sullying, particularly in gutting, cooling, bundling and transport stages where microbial development can happen (Christensen, 1997; Muth, 2009).

Foodborne outbreaks of Salmonellosis have been most considerably related with *Salmonella* in chicken meat (Manoj *et al*., 2015; Ejo *et al*., 2016) and specially with nontyphoidal *Salmonella enteritidis* and *Salmonella typhimurium* (Saravanan *et al*., 2015).

Everywhere, in spite of the establishment of several control measures, *Salmonella* infections carry on being problematic with millions of cases occurring yearly, both in humans and animals. The annual incidence of human salmonellosis globally has been evaluated to be 93.8 million cases (Khan *et al*., 2018).

Two human sickness disorders might be because of *Salmonella* spp.; Typhoid fever and Paratyphoid fever, which might be transmitted from human to human by fecal-oral course and human is the main supply. Conversely, gastroenteritis is generally brought about by *Salmonella enterica* serovars, which are found in the intestinal tract of both human and creatures (Bryan and Doyle, 1995).

Bacillus cereus bunch is boundless in nature and sustenance. A few individuals from this gathering are perceived as causing sustenance deterioration as well as medical problems (Gdoura-Ben Amor *et al*., 2018).

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ISSN: 2090-6277/2090-6269/

Bacillus cereus is a gram-positive microbe possessing various situations, including soil, plant materials and numerous sustenance. The life form causes nourishment deterioration and can deliver two particular sorts of poison, which contrast in the fundamental manifestations initiated in human (Rajkovic *et al*., 2006). Its manifestations are watery looseness of the bowels and regurgitating related with stomach torment (Tahmasebi *et al*., 2014). In spite of the fact that improvement is accomplished rapidly, however uncommon reports of death because of the association of the different inward organs, for example, the heart, lungs, liver at corruption (Dirnhofer *et al*., 1977) and deadly meningitis (Evreux *et al*., 2007). Poultry is likely sullied with *B. cereus* amid mechanical rearing, from dusty lodging conditions, from sullied chickens, or from feed. Feed items are considered as the wellspring of *B. cereus*, since some regular fixings, for example, wheat and wheat items just as, meat and vegetable proteins might be certain for *B. cereus* (Konuma *et al*., 1988; Granum, 1997). Spores survive, feed manufacture and readily colonize the gut of the chicken (Jadamus *et al*., 2001).

Accordingly, the present study was carried out to assess the confinement and recognizable proof of *Salmonellae* and *B. cereus* from retailed cut-up chicken and poultry meat items gathered from various retail markets.

Materials and methods

Collection of samples

A total of 175 random samples of cut-up chicken and chicken meat products, represented by frozen chicken breast, frozen chicken thigh, chicken luncheon, chicken burger and chicken frankfurter (35 of each), were collected from different supermarkets in New Valley and Cairo governorates. Each sample, weighting about 100g was aseptically transferred, without delay, in an insulated ice box to the Food Hygiene laboratory at the Faculty of Veterinary Medicine, New Valley University and the Zoonotic laboratory at the Faculty of the Veterinary Medicine in Academic Sadat City and then subjected to examination.

Isolation and identification of Salmonellae

Each sample (25 grams) was pre enriched in the buffered peptone water as recommended by Edel and Kampelmacher (1973) was applied. One ml of pre enriched broth was transferred aseptically to 10 ml of tetrathionate broth, then incubated at 37ºC for 24 hours, a loopful of enriched broth was streaked onto plates of Xylose Lysine Desoxycholate agar (XLD). The inoculated plates were incubated at 37°C for 24 hours. The suspected isolates were identified biochemically according to the technique recommended by Kreig and Holt (1984) and serologically according to the Kauffmann white scheme (Kauffmann, 1974).

Enumeration and Isolation of Bacillus cereus

By spreading technique (Mossel *et al*., 1967) using *Bacillus cereus* selective agar medium. Isolated organisms were identified morphologically and biochemically according to Cowan and Steel (1974).

Statistical analysis

Statistical significance was statistical analyses were done using SPSS 16.0 software package program (SPSS, Chicago, U.S.A.).

Results and Discussion

Among the major food-borne illnesses, salmonellosis has received the most attention. In the last decades, there is an increase of salmonellosis associated with poultry meat consumption in relation to salmonellosis originated from the consumption of other foods (Varnam and Evans, 1991).

The results given in Table 1, revealed that *Salmonellae* could be isolated from cut-up chicken meat including breast (8.6%) and thigh (5.8%). *Salmonella* organisms were previously isolated from chicken meat samples by Capita *et al*. (2003); Tibaijuka *et al*. (2003); Gad (2004); Khalifa and Abd El-Shaheed (2005); Huong *et al*. (2006) and Nawar (2007), who isolated *Salmonella* organisms from 8.89% and 11.11% of the examined samples of chicken breast and thigh, respectively. In contrast, Saad *et al*. (2015) detected *S. enteritidis*, *S. typhimurium* and *S. anatum* in thigh by percentages of 33%, 50% and 17%, respectively. The prevalence of *Salmonella* spp. in both the environment and the carcass samples were 59.62% and 70% respectively, which were isolated from a total of 1,214 samples at different steps of integrated broiler production company in Korea (Choi *et al*., 2014).

Presence of *Salmonellae* in chicken breast and thigh may be attributed to the apparent healthy birds, which carries *Salmonellae*, bad hygienic conditions during slaughtering, cross contamination either from other birds, instruments, machines, workers, scalding tanks, defeathering machine, crop removal, manual evisceration, chilling tanks and portioning of carcasses into different products (Sams, 2001). In addition, the contaminated slaughterhouse environments can lead in posterior carcass contamination of slaughtered chickens during the passage through the slaughter line (Marin *et al*., 2011; Henry *et al*., 2012).

Serological identification of *Salmonella* isolates recorded in Table (1) revealed that 5.7 % of *S. typhimurium* and 2.9 % *S. enteritidis* were isolated from chicken breast and 2.9 % of *S. typhimurium* and 2.9 % *S. enteritidis* were isolated from chicken thigh. Similar findings were recorded by Khalifa and Abd El-Shaheed (2005); Huong *et al*. (2006); Nawar (2007) and Yildirim *et al*. (2010) for *S. typhimurium*, Huong *et al*. (2006); Nawar (2007); Ulloa *et al*. (2010) and Yildirim *et al*. (2010) for *S. enteritidis*. While Balakrishnan *et al*. (2018) detected the high incidence of *Salmonella* spp. (33.3%) in chicken meat in India. The obtained results for *Salmonella* screening were not acceptable to those reported by EOSQ (ES: (1090/2005) (2005a) for frozen poultry, which stated that *Salmonellae* must be free.

Historically, *S. typhimurium* is the most frequently serotype and *S. enteritidis* is the second as causative agents of human

Table 1. Incidence and serological identification of *Salmonella* spp. isolated from the examined cut up chicken and chicken meat product samples (n= 35)

	Breast		Thigh		Burger		Luncheon		Frankfurter		Antigenic structure	
	No	%	No	%	No	%	No	%	No	%	O	H
S. typhimurium	2	5.7	1	2.9	-	-	-	-	-	-	1.4.(5),12	i:1,2
S. enteritidis	1	2.9	1	2.9	-	-	-	-	-	-	1,9,12	g,m
Total	3	8.6	2	5.8	-	-	-	-	-	-	-	-

gastroenteritis throughout the world. Thus, *S. typhimurium* was the commonest serotype isolated from cases of food poisoning and represents about 50-60% of the cases (Sharma *et al*.,1996). Accurately, FAO/WHO (1983) recorded that the cases of food poisoning outbreaks were due to *S. typhimurium*. About 407 cases were in Spain (1981), 237 in Poland (1980), 227 in Denmark (1981), 130 in Sweden (1981), 84 in Scotland (1981), 80 in Ireland (1981), 37 in Yugoslavia (1984), 22 in England, and 3 cases in Belgium (1981) (FAO/WHO, 1990).

High incidence of *Salmonellae* in poultry carcasses gave an indication of the public health hazards that might follow subsequent mishandling, inadequate cooking and cross-contamination. Vegetative cells of *Salmonella* in chicken meat should be heat treated until central temperature reaches 68.3 to 73.9ºC to be destroyed, in addition to curing, smoking and irradiation (ICMSF, 1980).

Salmonella creatures neglected to be recognized in chicken meat items (burger, lunch meeting, and sausage). About comparable discoveries were accounted for by Levine *et al*. (2001); Hashim (2003); Gad (2004); Khalifa and Abd El-Shaheed (2005); Karmi (2014); Ibrahim-Hemmat *et al*. (2014) and Saad *et al*. (2015). While *Salmonellae* could be detected by Nouman *et al*. (1986); El-Taher (1995) and Capita *et al*. (2003) in the examined chicken burger. Also, Elbayoumi *et al*. (2018) isolated 8.6 % of *Salmonella* spp. from chicken luncheon.

The absence of *Salmonellae* in chicken meat items might be ascribed to the diverse handling, which harmed these touchy microorganisms, for example, heat treatment, amid assembling and the nearness of concoction additives (Kuhn *et al*., 2011), utilization of antimicrobial substances such as chlorine segments and sorbates (Morrison and Fleet, 1985), the use of good assembling practices and HACCP framework in the preparing plants.

It was evident from the tabulated results in a Table (2) that chicken burger, luncheon and frankfurter were highly contaminated with *Bacillus cereus* in percentages of 17.1%, 14.3% and 11.4%, respectively. However, chicken breast and thigh in percentages of 5.7 % of each. In a study done by Mosupye and Von Holg (2000); *Bacillus cereus* was predominant in both raw and prepared food stuffs. They also mentioned that the presence of *Bacillus cereus* at high levels, indicate a potential risk of producing toxins.

The obtained data in Table 2, revealed that the mean values for *Bacillus cereus* count (cfu/g) were $3.14\times10^3\pm3.86\times10^2$ for chicken breast; $3.10^2\times10\pm2.80\times10$ for chicken thigh; $5.71\times10^3\pm3.04\times10^2$ for chicken burger; $8.48\times10^2\pm6.30\times10^2$ for chicken luncheon and $8.42\times10^2\pm6.31\times10^2$ for chicken frankfurter samples.

The obtained results of *Bacillus cereus* in cut-up chicken meat (breast and thigh) were nearly similar incidence lower than 10^3cfu/g to those reported by Sooltan *et al*. (1987); Ezz.Eldein (1998) and Gdoura-Ben Amor *et al*. (2018). The achieved results of *Bacillus cereus* in chicken meat products were nearly similar incidence to those reported by Ezz.Eldein (1998) and Zaharan-Dalia *et al*. (2008). Relatively, higher results were recorded by Hashim (2003) and Sudershan *et al*. (2012). The distributed a tainting level running more than 10^4 cfu/g, the amount of *B. cereus* a mass microorganism in such food might be identified with contamination vehiculated by food additives include din poultry meat amid cooking (Floristean *et al*., 2007) or to cross-defilements by the sustenance handlers, the cooking utensils or then again the earth. The nearness of *B. cereus* aggregate microscopic organisms in crude chicken meat might be because of the contamination amid butchering, preparing conveyance, transportation, or capacity of the meat. Deficient temperatures of cooking or the capacity of the crude poultry may likewise encourage bacterial development (Floristean *et al*., 2007). The high contamination level of processed foods may result from contamination of raw materials and the consequent obstruction of spores to warm or other manufacturing forms. Moderate cooling what's more, expanded capacity at room temperature enable the spores to sprout and re-develop (Borch and Arinder, 2002; Ankolekar *et al*., 2009). Biofilm of *B. cereus* exist on the surface of pipelines and other processing materials such as storage tanks can be a source of contamination of food being handled (Faille *et al*., 2014).

The nearness of bacterium in raw poultry is primarily be-

Table 2. Statistical analytical results of *Bacillus cereus* count/g of the examined cut-up chicken and chicken meat product samples (n=35)

	Positive samples		Mean ± SE
	No	%	
Breast	3	8.6	$3.14\times10^3\pm3.86\times10^2$
Thigh	3	8.6	$3.10\times10^2\pm2.80\times10$
Burger	6	17.1	$5.71\times10^3\pm3.04\times10^2$
Luncheon	5	14.3	$8.48\times10^2\pm6.30\times10^2$
Frankfurter	4	11.4	$8.42\times10^3\pm6.31\times10^2$

Table 3. Summarized results of microbial examination of the samples with comparing to the Egyptian standard (EOSQ, 2005a,b,c,d)

	Chicken breast (1090/2005)	Chicken thigh (1090/2005)	Chicken burger (2910/2005)	Chicken luncheon (1696/2005)	Chicken frankfurter (3493/2005)
Salmonella					
Permissible limit (P.L.)	Free	Free	Free	Free	Free
No. of sample within the P.L.	32 (91.4%)	33 (94.3%)	35 (100%)	35 (100%)	35 (100 %)
No. of samples exceeded the P.L.	3 (8.7%)	2 (5.7%)	0 (0%)	0 (0%)	0 (0%)
Bacillus cereus					
Permissible limit (P.L.)	Free	Free	Free	Free	Free
No. of sample within the P.L.	32 (94.3%)	32 (94.3%)	29 (82.9%)	30 (85.7%)	31 (88.6%)
No. of samples exceeded the P.L.	3 (8.7%)	3 (8.7%)	6 (17.1%)	5 (14.3%)	4 (11.4%)

cause of spores started on rearing homesteads, contaminating amid abattoir preparing and post preparing, taking care of run of the mill fixings utilized for feed of chicken, have been appeared to contain *B. cereus* (Rosenkvist and Hansen, 1995). In processed poultry products presence of bacterium is due to the surviving of spores from raw poultry, spores from the added ingredients and contamination with either spores or cells during processing. The more prominent level of tainting found on handled poultry contrasted with raw poultry meat, is a result of the synergies activity of various components. Fixings generally added to meat items, for example, flavors, seasonings, and protein supplements, have been found to contain *B. cereus* (Konuma *et al*., 1988). Also, the packing materials used in food industry prove to be a source of *B. cereus* (Pirttijarv *et al*., 2000).

The occurrence of *B. cereus* in chicken meat products (burger, lunch get-together and hotdog) were exceedingly debased than cut up chicken (breast and thigh). This marvels of *B. cereus* circulation of chicken meat items could be clarified on the premise that; the raw chicken meat does contain spores of *B. cereus* and this is rational due to the beforehand pollution condition, the qualities of the poultry handling activities. Be that as it may; the esteem included solidified raw items do contain the most noteworthy recurrence rate of segregated *B. cereus*. Regardless of the item being solidified; yet the high obligation of *B. cereus* expansion to item amid arrangement through the sullied added substances (extenders, utilitarian added substances, flavoring and flavors), which many of them could survive the freezing operation adapted in preparation of such products (Konuma *et al*., 1988). On the other side, the heat processed chicken meat products (Luncheon and frankfurter), which come second in the frequency of isolation, despite the product being heat processed yet; because of the contaminated additives usually enter the formulation of the raw products, many of the spores survived after processing

The data presented in Table 3, *Salmonella* and *Bacillus cereus*, which must be absent from the examined samples according to recommendation of EOSQ (ES: (1090/2005)) (2005a), were detected at an incidence of 8.6 % and 8.6% in chicken breast, respectively and at an incidence of 5.8% and 8.6% in chicken thigh. *Bacillus cereus* were detected at an incidence of 17.1%,14.3% and 11.4% in chicken burger, chicken luncheon and chicken frankfurter, respectively. While *Salmonella* finding was in agreement with the standard level in chicken burger, chicken luncheon and chicken frankfurter (EOSQ (ES: (2910/2005); (1696/2005); (3493/2005), 2005b, c, d).

So as to limit or forestall contamination of chicken meat (cuts-up) and chicken product by *Salmonella* spp. and *B. cereus* by improving the clean status of chicken cut-up processing and consequently the quality of chicken products, some recommendations should be carried out such as application of good hygienic practices, good manufacturing practices, hazard analysis and critical control point system in poultry processing operation.

Conclusion

Our study concluded that there is contamination of chicken (cuts-up) and chicken products by *Salmonella* spp. and *B. cereus* in Cairo and New Valley governorates.

Coflict of Interests

The authors declare that they have no conflict of interest.

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