Bacteriological Evaluation of Retailed Broiler Chicken Carcasses in Port-Said Province, Egypt

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Abstract

A total of 80 random samples of freshly slaughtered and chilled broiler chicken carcasses (40 of each) were collected from different private small-scale manual poultry processing shops and local retailers in Port Said Province-Egypt during the period extended from January to May 2020. All samples were subjected to bacteriological examination to evaluate the quality and safety of dressed chicken carcasses. The obtained results revealed that the incidence rates of *Escherichia coli*, salmonella and campylobacter in the examined freshly slaughtered broiler chicken carcasses samples were 65%, 50%, and 55%, respectively, while the aerobic colony counts ranged from 1.5×10^5 to1.1×10^6, with a mean value of $3.2 \times 10^5 \pm 4.2 \times 10^4$cfu/cm^2, respectively. Meanwhile, the incidence rates of *E. coli*, salmonella and campylobacter in the examined air chilled broiler chicken carcasses samples were 75%, 35%, and 40%, respectively, and the aerobic colony counts were ranged from 3×10^6 to 1.9×10^8, with a mean value of $4.1 \times 10^7 \pm 1.1 \times 10^7$cfu/cm^2, respectively. From the obtained results, it was concluded that dressed freshly slaughtered and air chilled broiler chicken carcasses could be contaminated with a variety of bacteria which reflected the standard of hygiene under which these carcasses were slaughtered, handled and stored in addition to the probable public health hazards.

Key words: Slaughtered chicken, ACC, salmonella, *E. coli*, campylobacter

Introduction

Chicken meat consumption contributes to improve the quality of the diet among developed and developing countries, it contains high protein content, unsaturated fats, vitamins, and minerals ***(FAO, 2010).*** There is an association between chicken consumption within a balanced diet and good health. Whereas, the consumption of chicken meat as part of a vegetable-rich diet,

associated with a risk reduction of developing obesity, cancer, cardiovascular diseases, and type 2 diabetes mellitus ***(Marangoni et al., 2015).*** Both chicken muscle and skin considered excellent substrates for supporting the growth of a wide variety of microorganisms due to high moisture content and nitrogenous compounds ***(ICMSF, 2005).*** Slaughtered chicken carcasses harbored a tremendous number of bacteria in the digestive tract, lungs, skin, feathers, and feet. In addition to that, the carcasses were contaminated from slaughterhouses, methods of slaughtering and liquids used in broiler processing. The improper storage during transportation and marketing can facilitate the multiplication of bacteria ***(Rouger et al., 2017).*** Moreover, all stages of broiler carcasses production stages provide opportunities for carcass contamination with Salmonella, Campylobacter, and *E. coli* ***(Ibrahim et al., 2015).*** The majority of consumers purchased broiler meat from the small retail outlets where chickens are slaughtered and dressed under unhygienic conditions ***(Das and Biswas, 2003).*** The prevailing conditions of the most of small-scale broiler processing units are not satisfactory for the hygienic standards because of lack of proper infrastructure, unsanitary conditions during processing, prolonged use of scald water, improper evisceration and a shortage and dilate of refrigeration after chicken carcasses processing ***(Yashoda et al., 2001).***

The presence of pathogenic and spoilage microorganisms in chicken meat is considered as one of the major challenges and concerns for suppliers, consumers, and public health officials worldwide ***(Chaiba et al., 2007).*** Whereas, Enteropathogenic Escherichia coli usually causes severe diarrhea and gastrointestinal illness ***(Smith and Fratamico, 2005).*** In addition to that, the consumption of poorly cooked with chicken meat contaminated with salmonella can cause severe health hazards ***(Rani et al., 2017).*** Also, campylobacter food poisoning which characterized by watery diarrhea, acute enteritis, and several complications***, (Boysen et al., 2014).***

The contamination of broilers chicken meat with food poisoning bacteria resulted in economic losses to retailers and processors. Therefore, this study was conducted to evaluate the bacteriological quality of freshly and air chilled broiler chicken carcasses purchased from small scale manual poultry processing shops and local retailers in Port

Said province via determination of ACC, and detection of *Escherichia coli,* Salmonella and Campylobacter.

Materials and Methods:

A total of 80 samples of broiler chicken carcasses including; 40 of freshly slaughtered broiler chicken carcasses and 40 of air chilled chicken carcasses (4-10^0 C) were randomly collected from different private small scale manual poultry processing shops and local retail shops in Port Said province.

Preparation of samples:

According to ***Thomas (1978),*** the technique recommended by ***USDA/FSIS (1996) and Thiessen (2000)***, the method of measuring the approximate internal, external and total surface area of commercially eviscerated poultry carcasses was used. After determining the weight, each carcass was rinsed with 400 ml of 0.1% peptone water, the carcass was allowed to drain for 15 seconds. Tenth fold serial dilutions up to 10^{-8} were prepared for determining ACC and detection *E. coli*. For salmonella and campylobacter 25 ml of rinse fluid was pre-enriching in 225 ml of sterile buffered peptone water for 18h ± 2 at 37^0C for salmonella and Preston selective enrichment broth under micro aerobic condition for campylobacter detection. Data from carcass rinse fluids, expressed as colony forming units (CFU) / ml, was converted to counts / cm^2 by using the formula published in FSIS / USDA microbial baseline survey ***(USDA, 1996).***

1. Determination of ACC as described by ***ISO (4833-1:2013).***
2. Detection of *Escherichia coli* as described by ***ISO (16649-2:2001).***
3. Detection of salmonella as described by ***ISO (6579-1:2017).***
4. Detection of campylobacter as described by ***ISO (10272-1: 2017).***

Results and Discussion

Food poisoning caused by consumption of contaminated chicken meats had a serious impact on consumer's health, as well as economic losses due to the cost of medical care and social costs ***(Alvarez-Astorga et al., 2003)***.

1. **Aerobic colony counts of freshly slaughtered broiler carcasses:**

Aerobic colony count used as an indicator of the hygienic measures applied during processing, storage, and marketing of food products ***(APHA, 2001)***. The data recorded in Table (1) revealed that the minimum, maximum and mean value ±SE of aerobic colony count of the examined freshly slaughtered were ranged

from1.5 × 10^5 to1.1 × 10^6, with a mean value 3.2 × 10^5± 4.2 × 10^4cfu/cm2 while in air chilled broiler carcasses samples they were ranged from 3 × 10^6 to 1.9 × 10^8, with a mean value of 4.1 × 10^7± 1.1 × 10^7cfu/cm^2. The recorded result for freshly slaughtered was nearly compatible with ***Hmd et al. (2017)*** who examined 50 of chicken carcasses and found that aerobic plate count ranged from 2.4×10^4 to 1.2×10^6, with a mean value 5.4×10^5±9.2×10^4cfu/g. On the other hand, this result was relatively lower than those found by ***Mira and Eskander (2007)*** who found that the mean value of aerobic plate count was 6.1±0.1 log 10 cfu/g in the collected samples, also the obtained result was relatively higher than those determined by ***Zhang et al. (2012)*** who recorded that the aerobic bacterial count by rinse method in the collected samples of broiler carcasses was 4.60±0.04log cfu/cm^2. By matching the results of aerobic plate count with **ES (2005)**, only10 % of freshly slaughtered broiler chicken carcasses samples was exceed the PL this result may attributed to the unsanitary conditions and high ambient temperature in poultry processing shops, and the unhygienic condition of handlers ***(Bailey et al., 1987)***. For air chilled carcasses, the obtained results were nearly similar to that result obtained by ***Uysal et al. (2020)*** who found that total ACC of whole broiler carcasses after 10 days of the cold storage at 4°C was 7.88 ± 0.58 log 10 cfu/ml, while these results were relatively lower than those results found by ***Nossair et al. (2015)*** who recorded that the APC ranged from 3×10^4 to 3.5×10^9, with a mean value 3.5×10^8±8.2×10^7cfu/g. On the other hand, these results were relatively higher than that obtained by ***Giombelli et al. (2013)*** who recorded that the aerobic plate count of broiler carcasses was 4.75 ±0.28 log cfu/ml. By matching this result with **ES (2005)**, it revealed that100 % of chilled broiler chicken carcasses had aerobic plate count above the permissible limit, these results could be explained by the cross contamination and fluctuating refrigeration temperatures which facilitated the growth of microorganisms ***(Sharma and Chattopadhyay, 2015)***.

The data recorded in Table (2) revealed that the incidence of *Escherichia coli*, salmonella and campylobacter in the examined freshly slaughtered and air chilled broiler carcasses samples which were 65%, 50% and 55%, and 75%, 30% and 40%, respectively. The obtained results for *E.coli* in freshly slaughtered chicken carcasses was nearly similar to this

reported by ***Seol et al. (2012)*** who determined the incidence of *E. coli* in chicken carcasses by using whole-chicken rinsing technique was 60.36%.On the other hand, this result was incompatible with the result determined by ***Yashoda et al. (2001)*** who couldn't detect *E. coli* in hygienically processed carcasses, while it was relatively lower than that obtained by ***Nossair et al. (2015)*** who isolated *E. coli* from freshly slaughtered chicken carcasses samples with an incidence of 80%.

The result of *Escherichia coli* in air chilled chicken was nearly similar to that result reported by ***Nossair et al. (2015)*** who isolated *E. coli* from chilled chicken carcasses samples with an incidence of 76%, while this result was relatively lower than those detected by ***Hmd et al. (2017)*** who isolated *E. coli* from chilled chicken carcasses samples by incidences of 88%. The presence of *Escherichia coli is considered* an indicator of direct or indirect fecal contamination during processing. Also the presence of *E. coli* in chilled chicken samples could be explained by cross contamination, bad hygienic conditions of vendors, and the improper storage condition ***(Naaz et al., 2020)***. For salmonella, the obtained results in freshly slaughtered chicken carcass was similar to that result obtained by ***Guergueb et al. (2014)*** who found that the prevalence of salmonella in chicken carcasses collected from slaughterhouses in the Biskra region, Algeria was 50%,also it was nearly similar to that obtained by ***Shafini et al. (2017)*** who determined the prevalence of salmonella in raw chicken samples sold from butcher shops in Malaysia by whole carcass rinse method was 54.2%.On the other hand, this result disagreed with those reported by ***Shaltout (2009)*** who failed to detect *Salmonella spp*. in the examined samples. By comparing this result with ***ES 1651 (2005)***, it revealed that 50% of freshly slaughtered broiler samples were not compatible to Egyptian organization for standardization and quality control for chicken carcasses. In air chilled chicken carcasses, the incidence of salmonella was nearly similar to that obtained by ***Alaliet al. (2012)*** who found that the prevalence of salmonella in whole chilled broiler chicken carcasses samples was 36.1%, while it was relatively lower than that obtained by ***Donado et al. (2012)*** who determined the incidence of salmonella in chilled chicken samples was 42%. By matching the results with ***ES 1651 (2005)***, it was clear that 35% of chilled broiler samples were not compatible to

Egyptian organization for standardization and quality control for chicken carcasses. The contamination of samples with salmonella might be attributed to unhygienic sources of carcasses which packed for sale or storage, cross contamination during handling preparation, and improper refrigerated .For campylobacter, the obtained results in freshly slaughtered chicken carcasses was nearly similar to that found by ***Kagambèga et al. (2018)*** who determined the prevalence of campylobacter in slaughtered chicken carcasses was 50%, while it was relatively lower than those detected by ***Nohra et al. (2018)*** who recorded that the prevalence of *campylobacter spp*.in whole chicken carcasses rinse samples was 60/72 (83.3%),On the other hand, these results were relatively higher than those found by ***Khalafalla et al. (2015)*** who found that the prevalence of *campylobacter jejuni* in fresh chicken broiler carcasses was 44%**.** On the other hand, the obtained result of campylobacter in air chilled broiler carcasses was nearly similar to the results found by **Oyarzabal *et al. (2005)*** who determined that the prevalence of campylobacter in chilled broiler carcasses rinse samples was 45.4%,while it was relatively higher than those obtained by ***Lindblad et al. (2006)*** who found that the incidence of campylobacter in chilled broiler chickens carcasses was 16%. The obtained results were relatively lower than those detected by ***Gonsalves et al. (2016)*** who revealed that the frequency rates of *campylobacter* spp. in chilled broiler carcass samples were 100%. The contamination of broiler with campylobacter could be explained by the unhygienic condition, cross contamination, and incorrect storage conditions, these result might be referred to contaminated birds, improper handling practices, incorrect plucking and evisceration, and low scalding temperature, ***(Seliwiorstow et al., 2016)***.

Table (1): *Statistical analytical results of aerobic colony count cfu/cm^2 of the examined samples of freshly slaughtered and Air chilled broiler chicken carcasses* ***(n =40)***

Broiler Carcasses	Min.	Max.	Mean	±SEM	Samples exceed PL	
					No	%
Fresh	1.5×10^5	1.1×10^6	3.2×10^5	4.2×10^4	4	10%
Air chilled	3×10^6	1.9×10^8	4.1×10^7	1.1×10^7	40	100%

PL: Permissible Limits

ES 1651:(2005) stated that aerobic colony count must not exceed 10^5 cfu/gm.

Table (2): *Incidence of Escherichia coli, salmonella and campylobacter in the examined samples of freshly slaughtered and air chilled broiler chicken carcasses* ***(n=40)***

Bacterial profile	Freshly slaughtered		Air chilled	
	No	%	No	%
Escherichia coli	26	65	30	75
Salmonella	20	50	14	35
Campylobacter	22	55	16	40

Conclusion:

In this study it was proved that broiler meat harbored high microorganisms with significant risk of meat spoilage because of unsanitary conditions, cross contamination, and poor personal hygiene conditions during processing, handling, packaging, storage, distribution and selling. Therefore, enhance the microbiological quality and increasing the shelf life of broiler meat is essential by implementation of strict sanitation practices and good hygienic procedures throughout the chain of broiler chicken processing.

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الملخص العربي

التقييم البكتريولوجي للدجاج اللاحم المتوفر في منافذ البيع في محافظة بورسعيد

حسني عبداللطيف عبدالرحمن- رنا محمد عمر- هبه محمد علي شاهين

تم فحص 80 عينة من دجاج التسمين الطازج والمبرد المجمعة من محلات الجزارة والأسواق المختلفة في مدينة بورسعيد في فترة امتدت من شهر يناير وحتى شهر مايو 2020 باستخدام طريقة الشطف الكلي للدجاجة الكاملة, وأوضحت النتائج أن نسبة تواجد الإيشيريشيا كولاي, السالمونيلا والكامبيلوباكتر في عينات الدجاج الطازج من محلات الجزارة هي 65%, 50% و 55% على التوالي, بينما كانت قيمة متوسط العدد الكلي للجراثيم الهوائية 3.2×10^5 ±4.2 × 104 جرثومة لكل سنتيمتر مربع. بينما أوضحت نتائج عينات الدجاج المبرد المجمعة من الأسواق المختلفة في مدينة بورسعيد أن نسبة تواجد الإيشيريشيا كولاي, السالمونيلا والكامبيلوباكتر في عينات الدجاج المبرد والمجمعة من محلات البقالة والأسواق في مدينة بورسعيد هي 75%, 35% و 40% على التوالي,وكذلك كانت قيمة متوسط العدد الكلي للجراثيم الهوائية لهذه العينات هي $4.1 \times 10^7 \pm 1.1 \times 10^7$ جرثومة لكل سنتيمتر مربع. ولقد خلصت الدراسة إلى أن لحوم دجاج التسمين المجمعة من الأسواق ملوثة بأنواع مختلفة من الميكروبات مما يعكس عدم تطبيق الاشتراطات الصحية أثناء الذبح والتجهيز والنقل والبيع والتخزين مما قد يشكل خطورة على صحة المستهلك ولذلك أوصت الدراسة بضرورة تطبيق الاشتراطات الصحية أثناء مراحل تجهيز الدجاج لتحسين الجودة الميكروبيولوجية للحم الدجاج وزيادة فترة الصلاحية