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Sources and Prevention of Contamination of Raw Chicken Meat in a Poultry Slaughterhouse in Qalyubia, Egypt.

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Abstract

CHICKEN MEAT can be contaminated during the slaughtering process. This study show the sources of raw meat cross-contamination and how to prevent it. A total of 40 samples of fresh chicken were examined twice; first time after chilling directly then examined again after deboning, 40 random hand swabs from the workers, and 90 random swabs from meat contact surfaces. All random swabs had taken before starting work. Another 3 hand swabs were taken to examine the effect of hand sanitizer and 24 swabs of contact surfaces to examine the effectiveness of using Chlorine-based sanitizers or peroxyacetic acid (PAA) in the sanitation of food contact surfaces. Chicken samples examined after chilling showed (0%) positive results for Aerobic Plate Counts, *Staphylococcus. aureus*, and *E. coli* but the same samples, due to microbial growth during deboning and packaging, showed positive results for APC (37.5%), *S. aureus* (25%), and *E. coli* (45%). Hand swabs showed positive results for Coliform (27.5%) and S. aureus (37.5%). Cutting boards' samples showed (60%) positive results for Coliform and (40%) for *S. aureus*, also knife samples showed (70%) positive results for Coliform and (75%) for *S. aureus*. Tables samples showed (25%) positive results for both of Coliform and *S. aureus*. Crates swabs showed (100%) positive results for Coliform, (90%) for and *S. aureus*. Using of Chlorine-based sanitizers or peroxyacetic acid (PAA) in the sanitation of meat contact surfaces after cleaning. Therefore, it is essential to adhere to strict hygiene protocols for both workers and equipment throughout the operation.

Keywords: Chicken Meat, Contamination, Poultry Slaughterhouse, Hygiene, Food Handlers.

Introduction

Cross-contamination refers to the movement of microbes from one substrate to another. Cross-contamination can be simply from one surface to another such as hand contact with a cutting board or from one location to another, such as when animals that have microbes on their intestine, legs, and feathers are transported from a farm to a processing plant. There are many forms of food cross-contamination; one of the important forms is people-to-food. Many bacterial pathogens normally live in the intestinal tract of healthy animals, including humans. The intestinal tract is a warm, wet, and nutrient-rich environment. Most of the microbes that live in our intestinal tract die when they are excreted as waste, because they are not aerobic bacteria. Illnesses occur when pathogenic bacteria are excreted, find a suitable food substrate to colonize or reside on, and then are ingested by people who become infected. There are an estimated 1000 different species of bacteria that live in a healthy human gut, but only a few species that cause foodborne illnesses and outbreaks. These include E. coli, Salmonella, and Campylobacter bacteria, all of which can live for extended periods outside the body [1]. Humans may readily transmit germs from their bodies or garments to food throughout many stages of food handling and preparation. For instance, a someone could cough into their hand or come into contact with uncooked chicken and proceed to cook a meal without engaging in hand hygiene in the meantime [2].

Another kind of cross-contamination occurs when equipment comes into contact with food. Bacteria have the ability to last for extended durations on surfaces such as cutlery, cutting boards, containers, and food preparation equipment. Inadequate washing and sanitization of equipment may result in the significant transmission of detrimental germs to food [3]. The third category is food-to-food. Introducing

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contaminants into uninfected food leads to food-to-food cross-contamination. This facilitates the dissemination and proliferation of pathogenic microorganisms [3].

The global consumption of poultry meat is consistently rising, with the latest available statistics indicating that it has reached 14.2 kg/capita/year [4]. Hence, guaranteeing the microbiological integrity of chicken meat products is a crucial concern in light of the growing consumption and production. Indeed, bacteria originating from the microbiota of animals, the environment of the slaughterhouse, and the equipment utilized, contaminated carcasses, its subsequent cuts, and meat that has been processed both during and following the slaughtering process [5]. Between 1998 and 2012, it was shown that the primary reason for foodborne outbreaks in the USA was the eating of poultry [6]. In healthy live birds, muscles are devoid of bacteria, while numerous microbes reside in the digestive system, skin, lungs, feathers, and other areas. Bacteria are present on the surfaces and equipment of slaughterhouses. Consequently, the remains of animals and sections of meat following the process of slaughtering might get tainted by the microorganisms present in the animals and the slaughterhouse. While there may be variations in the procedures followed in large-scale commercial slaughterhouses and small-scale slaughtering facilities, the fundamental stages of chicken slaughtering remain consistent. Dirty areas (low risk) include resting, receiving, hanging, killing, bleeding, scalding, de-feathering, and evisceration. Clean area (high risk) includes chilling, deboning, packaging, and storage [7]. Typically, it is recommended not to consume food for duration of 8 to 12 hours before to slaughtering in order to completely empty the digestive system (from the crop to the vent), while ensuring that the intestines remain strong and intact. Preserving the structural integrity of the intestines is of utmost importance in order to avoid the occurrence of tears and fractures during the processing phase, as well as to reduce the associated risk [8].

The water baths utilized throughout the scalding process have a cleansing impact that reduces the presence of germs, but they may also facilitate the transfer of contaminants across carcasses [9]. The elevated temperatures (55 to 60 °C) of the hot water utilized for scalding aid in halting the growth of bacteria. This aids in reducing the diversity of bacteria seen on the skin. Nevertheless, elevated temperatures cause feather follicles to expand and poultry skin to become more relaxed. Subsequent processing stages may result in the transmission of microorganisms from the surrounding region to the skin and follicles, which have been expanded by the hot water [10].

The evisceration stage, since the abundant presence of bacteria in the digestive system, is a crucial moment for carcass infection. Birds' gastrointestinal system harbors several bacteria, including potentially hazardous ones as salmonella or campylobacter spp. [11]. The most prevalent problem that arises throughout the process evisceration is the contamination with debris from the gastrointestinal system. This contamination arises when mechanical evisceration causes a rupture in a portion of the tract. The most prevalent sources of contamination throughout the procedure are the contents of the intestines, gall, proventriculus, and crop. The expelled contents have the potential to infect not just the corpse from which they originated, but also additional carcasses and equipment. The contamination of equipment significantly amplifies the likelihood of future carcasses becoming contaminated [8].

The poultry slaughterhouse is divided into 2 main areas; dirty area (receiving, killing, scalding, de-feathering, and evisceration) and clean area (chilling, deboning and packaging). Strict surveillance of the barriers separating zones is of utmost importance. These barriers may take the form of either walls or windows, allowing for the movement of materials. It is necessary to conduct a comprehensive evaluation of access points for goods and workers, air and utilities, and also traffic conditions in order to establish suitable regulations that guarantee compliance with the required sanitary standards. An access point comprises doors, windows, apertures of varying dimensions, ventilation apertures, and drainage systems [12]. After removing the bird's internal organs, it is crucial to chill the body and ensure the appropriate temperature is maintained for the whole procedure. The objective is to expedite the cooling process of the carcass in order to impede bacterial proliferation, preserve its shelf-life, and optimize its production. Bacterial growth may occur when temperatures above 4°C (40 °F). Carcasses exceeding an internal temperature of 4°C (40 °F) may experience more dripping when handling and packaging, as well as greater loss of moisture and natural juices throughout processing. In order to mitigate microbiological concerns while preserving productivity and excellence, it is essential that items leaving the chiller possess an internal temperature that is lower than 4°C (40 °F). Various techniques are utilized for chilling chicken carcasses. Certain operations utilize uncomplicated techniques that include doing batch operations in ice or a combination of ice and water, whilst others perform batch chilling on racks inside a stationary air chiller. Additionally, there is a growing popularity of combination systems that use water immersion or sprays together with air cooling [8].

The process of cooling carcasses following evisceration may serve as a means of cross-contamination among carcasses. However, it additionally produces a disinfecting impact by cleaning the surface of the corpses, especially when

chlorine is introduced into the water [10]. Chilling the air in refrigerators decreases down the growth of the number of viable organisms and leads to a quick drop in temperature. Chilled-air cooling is more effective because it prevents the proliferation of both Campylobacter and Salmonella [13]. The primary chemical employed in chiller systems for its antimicrobial properties is chlorine, specifically sodium hypochlorite. The concentration of chlorine utilized shouldn't go above 50 ppm, according to measurements in the incoming potable water [14]. The level of contamination of carcasses dropped following being submerged in cold water for chilling, and then rose throughout the processing and storing at refrigeration temperatures [15].

Typically, the temperature in processing facilities throughout carcass handling is about 10 ◦C (15 ◦C or lower) [16]. Manipulators and surfaces of equipment are the primary sources of contamination throughout the deboning, cutting, and packing stages of meat-based food manufacturing. As a result, the prevalence of bacteria in items is elevated (after deboning and packaging) than on primary chickens (after chilling) [17].

Poultry carcasses and cuts come into direct touch with equipment surfaces, making them susceptible to contamination. Bacteria are found on the surface of fresh meat, rather than within the meat itself [18]. Effective management of the cut and packing environments is crucial for achieving optimal production rates of superior quality and safe goods. The environment's design should adhere to the regulations and standards set by food safety and regulatory agencies, ensuring that it can be effectively cleaned and sanitized. Performing pre-operational and post-sanitation cleansing inspections is crucial for maintaining a high-quality production environment. Pre-operational sanitation ought to involve the cleaning of both direct and indirect touch surfaces, such as the legs of the table, overhead-line turn wheels, and track. Areas, such as the ceilings and walls, that aren't cleaned on a daily basis ought to be included in a routine cleaning program. Conduct equipment and surface inspections to verify their compliance with a standard microbiological validation methodology. It is essential to implement a thorough cleaning program for supporting materials including tubs, racks, and cutting implements to effectively eliminate any organic buildup and biofilm [8]. The safety and longevity of most foods, especially those that need refrigerators, are highly dependent on temperature [19]. Storing at low-temperature and maintaining an unbroken cold chain may extend the product's shelf-life [20]. The shelf-life may be extended by up to two times when the temperature is reduced to 3.4 ◦C, as opposed to storing it at 8.3 ◦C. Enterobacteriaceae development is hindered by low-temperature, that may lead to the production of sulfuric compounds and the loss of quality of meat in terms of taste and smell [21]. Cryogenic storage at -18 ◦C effectively inhibits the proliferation of the majority of bacteria, while refrigeration at temperatures below 5◦C just retards their development. Throughout the product's lifespan, it may encounter situations that might cause the food to deteriorate and have a reduced shelf-life. These circumstances include rising or varying temperatures and high levels of humidity [22].

The objective of this research is to identify the possible origins of contaminants in meat in poultry slaughterhouses, starting with the arrival of live birds to the storage of the finished product, and to propose preventive measures to mitigate this contamination.

Material and Methods

Collection of samples

A total of 40 fresh chicken samples were collected at random and subjected to two rounds of examination: immediately following chilling and again following cutting and packaging. Forty random hand swabs were taken from the workers, whereas ninety random swabs were collected from meat-contacting surfaces such as knives, tables, cutting boards, and boxes. Pre-operational random swabs were obtained prior to commencing work. An additional three hand swabs were collected to assess the impact of sanitizing the hands, while 24 swabs containing surfaces were collected to evaluate the effectiveness of Chlorine-based sanitizing and combinations of hydrogen peroxide and peracetic acid in the sanitizing and cleansing protocol. An additional three hand swabs were collected to analyze the impact of hand sanitizer. Furthermore, twenty-four swabs of touch surfaces were collected to assess the effectiveness of Chlorine-based sanitizing and combinations of peracetic acid and hydrogen peroxide (Peroxyacetic acid or PAA) in the sanitizing and cleansing protocol.

Sample preparation

By utilizing sterile instruments, 10 grams of each of the specimens had been homogenized in a sterilized homogenizer using 90 ml sterilized buffered peptone water (BPW) 0.1% at 2500 rpm. for 3 min resulting in a homogenate of 1/ 10 initial dilutions. Starting with a dilution of 1 in 10, 1 ml of the solution was transferred into a tube comprising 9 ml of sterile BPW 0.1%. This diluted solution was then further diluted by a ten–fold [23].

Aerobic Plate Counts (APC) determination

After the first dilution, 1 ml of the solution was carefully transferred into two sterilized petri dishes. Then, roughly 15 ml of sterilized melted and tempered plate count agar (MERCK UM1401630150) had been added into each dish. Following complete mixing, the dishes had been

allowed to get firm at room temperature and subsequently kept at 37 ºC for 24- 48 h in an inverted posture. The calculation of total APC/g was performed on plates that contained a range of 25-250 colonies, as specified by ISO guidelines from 2003 [24].

Detection of S. aureus

A volume of 0.1 ml of each pre-prepared serial dilution was evenly distributed over the surface of Petri plates with BaridParker agar medium utilizing a spreader. The plates had been maintained in upright posture until the inoculums were absorbed by agar around 10 min. The plates containing the infected and control samples were turned upside down and placed in an incubator set at a temperature of 37 ºC for a period of 24 to 48 hours. The perfect colonies of *S. aureus* were seen as black, glossy, and convex, with a surrounding region exhibiting opacity. The total count of *Staphylococci* was determined using the FDA method. (2001) [25]

Coliform detection in swabs

Place the swab into 10 ml of sterilized peptone water saline to create a first dilution of 1/10. Mix the solution using a homogenizer. Dispense 1 ml of the first dilution into 2 petri dishes. Subsequently, add 15 millilitres of sterilized tempered Violet Red Bile Lactose agar (VRBL) to all Petri dishes. Let the agar to harden at room temperature for a duration of ten minutes. Once the agar has solidified, apply an additional layer of VRBL agar to the plates and let it become solid once again. Subsequently, incubate the plate at a temperature of 37 ºC for a duration of 24 hours, following which the colonies may be counted. Colony formations that are purplish red in colour, have a minimum diameter of 0.5 mm, and may be encircled by a reddish zone of precipitated bile are regarded to be characteristic of coliforms. These colonies don't demand any more confirmation [26].

Determination of E. coli

Transfer one ml from the pre-prepared dilution of the sample by sterile pipette to 2 petri dishes. Add 15 ml of sterile milted tempered agar of Tryptone Bile Glucuronic Agar (TBX) to each petri dish and mix thoroughly. Allow dishes to become more solid at room temperature for 10 minutes then incubate at 40-42 ºC for 20-24 hours then all developed colonies which were clear blue surrounded by clear zone were counted [27].

Results

Chicken samples

A total of 40 collected samples of fresh chickens examined microbiologically directly after chilling (the step that chlorine based sanitizer is added by 50 ppm). The results showed 0% positive to APC, E. coli, and S. aureus. After workers handling and using meat contact surfaces, the results showed 15 positive results for TPC (37.5%), 18 for E. coli (45%), and 10 for S. aureus (25%). Positive sample when results were $>10^5$ CFU/g for TPC and > 100 CFU/g for E. coli and S. aureus based on Egyptian Organization for Standardization and Quality (EOS) (Table 1).

Hand swabs

Forty random pre-operational hand swabs showed 10 positive results for APC (25%), 11 for coliform (27.5%), and 15 for S. aureus (37.5%). Positive sample when results were >100 CFU/swab for TPC and > 10 CFU/swab for coliform and S. aureus according to Center for Disease Control and Prevention (CDC) guideline (Table 2).

There were 3 more hand swabs examined to evaluate hand washing step; the first swab taken before start washing, the second taken after using soap, and the third taken after using alcohol 70% based sanitizer (Table 3).

Meat contact surfaces

The 20 examined swabs of knives showed 10 (50%) positive results for APC, 15 (75%) for *S. aureus*, and 14 (70%) for coliform. The cutting boards 20 swabs showed 11 (55%) positive results for APC, 8 (40%) for S. aureus, and 12 (60%) for coliform. 20 swabs of tables showed 6 (30%) positive results for APC, 5 (25%) for *S. aureus*, and 5 (25%) for coliform. But the 30 swabs of crates showed 30 (100%) positive results for both of APC and Coliform and 27 (90%) positive results for S. aureus. Positive sample when results were >100 CFU/swab for APC and > 10 CFU/swab for coliform and *S. aureus* according to CDC guideline (Table 4).

Using of chlorine-based sanitizer (Sodium hypochlorite) in sanitation of meat contact surfaces - after cleaning and removal of any residue of organic matters – showed negative results for APC, Coliform, and *S. aureus* when dipping in 50 ppm concentration for disinfection of knives and cutting boards or spraying tables. Concentration less than 50 ppm (10 ppm) showed positive results for ATPC (15x10 CFU/swab) in case of knives and (20x10 CFU/swab) in tables swabs. In case of cutting boards, 10 ppm concentration showed positive for APC (12x10 CFU/swab), Coliform (4x10), and *S. aureus* (2x10 CFU/swab). Disinfection of crates needed 100 ppm concentration at least to give negative results for APC, coliform, and S. aureus because of less concentration (50 ppm) showed positive results for APC (90x10 CFU/swab), coliform (17x10 CFU/swab), and *S. aureus* (52x10 CFU/swab).

Combination of peroxyacetic acid (PAA) and hydrogen peroxide can be used by 100 mg/l for sanitation of tables, cutting boards, and knives. Less concentration (50 mg/l) showed positive results for APC (20x10 CFU/swab) when sanitizing knives,

(6x10 CFU/swab) when sanitizing cutting boards, and positive results for both of APC (18x10 CFU/swab) and coliform (3x10 CFU/swab) when sanitizing tables. Sanitation of crates needed using the combination by 0.5% concentration for sowing negative results. Less concentration (0.25%) showed positive results for APC (50X10 CFU/swab) and S. aureus (8x10 CFU/swab) (Table 5)

Discussion

Zoonotic food-borne infections, which are prevalent globally, frequently spread via chicken meat. These illnesses not just have a significant effect on the public's health but additionally result in substantial economic expenditures [28]. The diseases are linked to many significant pathogens, including *S. aureus*, Campylobacter, Salmonella spp., Listeria monocytogenes, and E. coli [29]. Poultry-meat and derived products are measured a chief source of human infection with Salmonella. Chickens can be infected with many diverse serovars of this bacterium [30]. The presence of disease-causing bacteria, like E. coli in poultry processing has been well investigated and is linked to both poultry processing and poultry-related goods [31]. There is an abundance of publications documenting cases of foodborne illness resulting from the consumption of poultry flesh polluted with harmful bacteria. The absence of adequate sanitary measures in the slaughterhouse setting might serve as a substantial reservoir for contamination by bacteria [32]. Multiple infectious agents originating from several sources have the potential to infect chicken meat products at various stages, including pre-processing, processing, and post-processing activities such as packing, marketing, and storing. These pathogenic germs make the chicken products dangerous for customers and unsuitable for consumption by humans. Several indicators may be utilized to assess the hygienic condition of chicken products, including APC, total staphylococcal count, Pseudomonas count, and coliform. These indications are routinely employed to assess the cleanliness of chicken meat and the manufacturing process of its derived products [33].

The aerobic plate count (APC) serves as an indication of quality of chicken meat, contamination by bacteria, and the effectiveness of sanitary procedures used throughout processing. The 40 chickens examined directly after chilling step (immersion of chickens in cold water with 50 ppm chlorine concentration) were totally accepted (APC less than 10^3 CFU/gm). According to EOS, out of the same 40 chickens; 15 (37.5%) samples showed positive results for APC (more than 10^5 CFU/gm) after the chickens deboned and handled by the workers hands and came in contact with surfaces like crates, knives, and cutting boards (Table 1). Therefore, many swabs were taken from both of the workers and meat contact surfaces to discover the sources of contamination.

In Table 2, 40 random hand swabs taken from the hands of workers (pre-operational) that showed 10 swabs (25%) positive for APC (more than 100 CFU/swab according to CDC guideline). Meat contact surfaces swabs showed various positive results for APC. Worst results belonged to crates swabs that showed 30 positive swabs of totally 30 swabs collected (100%). Swabs of knives and cutting boards were less badly. 20 swabs of knives (pre-operational) showed 10 positive results (50%) for APC and 20 swabs of cutting boards showed 11 positive results (55%). Tables' swabs showed 6 positive swabs of 20 samples (30%) for APC (Table 4). The elevated APC might be ascribed to the contaminants of chicken products from several origins, together with inadequate processing and unfavourable conditions [34]. But in our study, poor cleaning and sanitation application of crates was considered the main cause of contamination of chicken samples due to long contact time between the crates and raw meat. S. aureus was recognized as the etiological agent responsible for staphylococcal food poisoning, a form of gastroenteritis resulting from the ingestion of meat contaminated with one or more pre-existing enterotoxins produced by staphylococcus aureus [35]. Spreading of S. aureus might sometimes take place in the community due to the ingestion or manipulation of infected foods. Studies have clearly shown that these bacteria can trigger serious foodborne illnesses in people who are in good health, and this has been seen over a long period of time [36]. *S. aureus* infection in meat arises from inadequate hygienic practices throughout slaughter and handling, as well as the substandard quality of water utilized for the processing of meat. It may manifest at various stages along the whole process, which includes meat production, slaughtering, handling, and marketing to humans [37].

In this study, the 40 random swabs of workers' hands showed 15 (37.5%) positive results for *S. aureus* (Table 2), 20 samples of knives showed 15 (75%) results positive for *S. aureus*, 20 samples of cutting boards showed 8 (40%) results positive and 20 samples of tables showed 5 (25%) positive results. Also in *S. aureus* swabs, worst results were belonged to crates' swabs that showed 27 positive results of 30 samples (90%) that showed in table 4. The presence of *S. aureus* in chicken product samples suggests that it originated from the food handlers (that may transfer the bacteria to knives) and inadequately cleaned equipment specially crates. Animal-derived food often contains E. coli bacteria that are often present in the intestinal flora of humans as well as animals. These bacteria may help inhibit the growth of dangerous pathogens in the gastrointestinal system. Some strains of E. coli often acquire pathogenic characteristics as a result of specific genes found in transmissible genetic components, which contribute to their pathogenicity and virulence

[38]. *E. coli* is a naturally occurring bacterium found in the digestive systems of warm-blooded animals as well as humans. When it is found in chicken meat products, it indicates that the meat has been contaminated with fecal matter, as well as potentially other disease-causing bacteria. Pathogenic strains of E. coli have been linked to several instances of foodborne illnesses in humans [39]. The propensity of some strains of this disease to produce thermally stable enterotoxins (Shigga toxins) has led to several instances of foodborne illness, especially when meat is not thoroughly cooked or prepared improperly [40]. E. coli had been identified before in 26.67% of the analyzed chicken meat items [41].

According to EOS, samples of the 40 deboned chickens showed 18 positive samples foe *E. coli* (45%) (Table 1). The 40 hand swabs showed 11 (27.5%) positive results for Coliform (table 2). Swabs of meat contact surfaces showed 70% of knives' swabs, 60% of cutting boards' swabs, 25% of tables' swab, and 100% of crates' swabs were positive results for coliform (Table 4). The results of this study explained the main sources of contamination in our slaughterhouse. Poor cleaned and disinfected crates (that contain raw meat) were considered the main source of contamination, the knives and handlers came in the second grade, cutting boards and tables had lower effect.

After cleaning and removal of any organic residues, using of Chlorine-based sanitizers (50 ppm concentration for chicken and meat contact surfaces except crates that need 100 ppm) or combination between peroxyacetic acid and hydrogen peroxide (100 mg/l concentration for meat contact surfaces except crates that need 0.5% concentration) in sanitation program of meat contact surfaces for prevention of cross-contamination (Table 5).

Contamination of raw meat may occur at several stages, such as throughout the initial manufacturing process of slaughtering or throughout subsequent processing and handling. This can include cross-contamination throughout processing or contaminated by those who handle food [42]. These illnesses are more likely to be transmitted by workers via the use of processing equipment, which includes knives, and due to inadequate sanitation and hygiene procedures [43]. Contamination may arise throughout the process of slaughtering due to being in contact with the hands and equipment of slaughterhouse personnel [44]. The poultry industry operates as a vertically integrated system including production, processing, and distribution. Within the broiler farming industry, this approach allows producers to combine different biosecurity and sanitation methods, housing technological advances, and feeding schedules in order to enhance the safety of food [45].It is crucial to prioritize the provision of comprehensive training in food hygiene to those responsible for handling this particular kind of food. This is necessary to prevent dangerous behaviours, like cross-contamination or inadequate cooking, and ultimately minimize the hazards posed to customers [46]. To prevent cross-contamination, it is essential to maintain rigorous hygiene and sanitation protocols throughout the food preparation procedure [47].

Poultry meat is nutrient foodstuff with boost beneficial effects on human health. It is rich source of protein, fat and some kinds of vitamins essential for healthy life. However, considering the low hygienic circumstances of abattoir, several outbreaks of foodborne diseases have been reported in diverse parts of the world [48]. Poultry GIT microbiota and mycobiota should be carefully investigated for meat, litter, aerosol, and processing plant contamination to ensure both food and personnel safety [49].

Conclusion

The achieved results in the present study prove that Poultry chicken meat and the surfaces that come into touch with the meat are extensively infected with *S. aureus* and *E. coli* bacteria. This contamination poses a significant risk to human health and is a key contributing factor to many health issues. They serve as indicators of fecal contamination and inappropriate handling throughout the meat preparation procedure. These organisms not just provide a substantial risk to human well-being, but they additionally have a notable financial consequence on the poultry industry due to their ability to cause death and illness. Hence, it is essential to adhere to strict hygiene requirements when it comes to slaughtering and processing meat.

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None

Conflict of interest

We declare that no conflict of interest.

TABLE 1. Comparison between 40 examined chicken samples after chilling and after handling

	Number	Positive APC	Positive *E. coli*	Positive *S. aureus*
Samples after chilling	40	-	-	-
%		0	0	0
Samples after handling	40	15	18	10
%		37.5	45	25

TABLE 2. Results of 40 random pre-operational hand swabs from the handlers

	Number	Positive APC	Positive Coliform	Positive *S. aureus*
Hand swabs	40	10 (25%)	11 (27.5%)	15 (37.5%)

TABLE 3. Evaluate the step of hand washing before and after using hand sanitizer

	Concentration	APC	Coliform	*S. aureus*
Before start washing	-	125x10	4x10	6x10
After using hand soap	-	55x10	<10	1x10
After using hand sanitizer	70%	<10	<10	<10

TABLE 4. Results of meat contact surfaces random swabs

	No.	Positive APC	%	Positive Coliform	%	Positive S. aureus	%
knives	20	10	50	14	70	15	75
Cutting boards	20	11	55	12	60	8	40
Tables	20	6	30	5	25	5	25
Crates	30	30	100	30	100	27	90

TABLE 5. Effect of using some chemicals on hygienic condition of meat contact surfaces, results (CFU/swab)

	Chemicals	Concentration	TPC	Coliform	*S. aureus*
knives	Chlorine	10 ppm	15x10	<10	<10
	Chlorine	50 ppm	<10	<10	<10
	PPA	50 mg/l	20x10	<10	<10
	PPA	100 mg/l	<10	<10	<10
Cutting boards	Chlorine	10 ppm	12x10	4x10	2x10
	Chlorine	50 ppm	<10	<10	<10
	PPA	50 mg/l	6x10	<10	<10
	PPA	100 mg/l	<10	<10	<10
Tables	Chlorine	10 ppm	20X10	<10	<10
	Chlorine	50 ppm	<10	<10	<10
	PPA	50 mg/l	18X10	3X10	<10
	PPA	100 mg/l	<10	<10	<10
Crates	Chlorine	50 ppm	90x10	17x10	52x10
	Chlorine	100 ppm	<10	<10	<10
	PPA	0.25%	50x10	<10	8x10
	PPA	0.50%	<10	<10	<10

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مصادر تلوث لحم الدجاج الخام وطرق منع حدوث التلوث داخل مجزر دواجن فى القليوبية- مصر.

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المستخلص

تتعدد مصادر تلوث لحم الدجاج الخام بالميكروبات أثناء عملية الذبح والتجهيز والتعبئة داخل مجازر الدواجن من خلال المتعاملين مع الغذاء أو الأسطح الملامسة له. هذة الميكروبات التى من الممكن أن تنتقل للإنسان وتسبب له أضرار صحية بالغة. تهدف هذة الدراسة إلى عرض مصادر التلوث للحم داخل المجزر وبعض الإرشادات الهامة للحد منها. تم أخذ 40 دجاجة طازجة وفحصها مرتين؛ المرة الأولى بعد خطوة التبريد والتطهير والثانية بعد أن تم تشفيتها وتعبئتها. كما تم أخذ 40 مسحة من أيدى المتعاملين مع الغذاء و 90 مسحة من الأسطح الملامسة للغذاء بشكل مباشر (المنضدة، السكاكين، طاولة التقطيع، وأقفاص اللحم الخام) وقد تم أخذ جميع المسحات بشكل عشوائى قبل بداية العمل. عينات الدجاج تم إختبارها للكشف عن العد الكلى للبكتيريا الهوائية (Aerobic Plate Counts)، البكتيريا العنقودية الذهبية (Staphylococcus aureus)، والبكتيريا الإشريكية القولونية (Escherichia coli). بينما تم إختبار المسحات للعد الكلى للبكتيريا الهوائية (Aerobic Plate Counts)، والبكتيريا العنقودية الذهبية (Staphylococcus aureus)، والبكتيريا القولونية(coliform). تم أخذ 3 مسحات إضافية من أيدى العاملين لفحص كفاءة إستخدام مطهر الأيدى وكذلك 24 مسحة إضافية من الأسطح الملامسة للغذاء مباشرة لفحص مدى فاعلية إستخدام بعض مطهرات الأسطح المعتمدة على الكلور أو مطهر آخر معتمد على مزيج بين حمض البيرأسيتك وماء الأوكسجين (PAA). عينات الدجاج التى تم فحصها بعد خطوة التبريد والتطهير مباشرة لم تظهر أى نوع من التلوث وذلك لأن خطوة التطهير فى الشيلر باستخدام كلور تركيز 50 جزء فى المليون كافية لإزالة الحمل الميكروبى ولكن نفس الدجاج عندما تم فحصه بعد التشفية والتعبئة أظهرت نتائج إيجابية (وفقا للمواصفات القياسية المصرية) بنسبة (37.5%) للعد الكلى للبكتيريا الهوائية و(25%) ل S. aureus و(45%) ل E. Coli. العينات العشوائية لمسحات الايدى للمتعاملين مع الغذاء أظهرت نتائج إيجابية ل Coliform بنسبة (27.5%) و (37.5%) ل S. aureus. نتائج طاولات التقطيع أظهرت نتائج إيجابية بنسبة (60%) ل Coliform ونسبة (40%) ل S aureus. كذلك نتائج فحص السكاكين المستخدمة فى التشفية أظهرت نتائج إيجابية بنسبة (70%) ل Coliform و نسبة (75%) ل S. aureus. عينات المنضدة أظهرت نتائج إيجابية بنسبة (25%) لكلا من Coliform و S. aureus. نتائج مسحات الأقفاص التى يتم وضع اللحم الخام بها أظهرت نتائج سيئة جدا قبل بداية العمل حيث أظهرت نتائج إيجابية بنسبة (100%) ل Coliform و نسبة (90%) ل S aureus.. إستخدام المطهرات المعتمدة على الكلور كمادة فعالة بتركيز 50 جزى فى المليون كافى لتقليل الحمل البكتيرى وإعطاء نتائج جيدة مع اللحم والأسطح الملامسة للغذاء باستثناء أقفاص اللحم الخام التى تحتاج إلى تركيز 100 جزء فى المليون. استخدام مزيج بين ماء الأوكسجين وحمض البيرأوكسى أسيتك (PAA) بتركيز 100 ملل/لتر كافى لتطهير الأسطح الملامسة للغذاء باستثناء أقفاص اللحم الخام التى تحتاج إلى تركيز 0.5%. يتم إستخدام هذة المطهرات بعد عملية تنظيف جيدة وإزالة أى مواد عضوية متبقية على الأسطح قبل التظهير.

بالنظر لهذة النتائج فإن لحم الدجاج داخل المجزر يكون فى أقل حمل بكتيرى له بعد الخروج من خطوة التبريد والتطهير مباشرة ولكن بعد ذلك يبدأ النمو البكتيرى فى التزايد بسبب تعدد مصادر التوث من خلال المتعاملين مع الغذاء أو الأسطح الملامسة بطريقة مباشرة للغذاء وخاصة أقفاص اللحم الخام والسكاكين، مثل هذا التلوث قد يؤدى إلى أمراض منقولة عن طريق الغذاء. لذلك؛ فإنه من الضرورى التزام العاملين بالاشتراطات الصحية وكذلك لابد من تطبيق برنامج نظافة وتطهير قوى للأدوات والأسطح الملامسة للغذاء.

الكلمات المفتاحية: لحم الدجاج، التلوث، مجزر دواجن، الإشتراطات الصحية، المتعاملين مع الغذاء.