



**Research Paper**

**PREDOMINANCE OF *Escherichia coli* AND *Staphylococcus aureus* ON SWABS OF FOOD CONTACT SURFACES COLLECTED FROM RETAIL POULTRY SHOP**

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**Abstract**

Number of studies reported that raw chicken is contaminated with various pathogen among which *Escherichia coli* and *Staphylococcus aureus* are predominant. To identify contaminating sources of these pathogen, three food contact surfaces were selected namely hands of worker, knife and wooden block from the retail poultry shop and their swab were taken for microbial analysis. Obtained results showed that, all three contact surfaces found contaminated with test pathogens. *E.coli* found predominant in knife swab samples(88.3%) followed by cutting surface swab (73.3%) and hand swabs (68.3%). On the other hand, *S.aureus* found predominant in hand swab (100%) followed by Cutting surface (95%) and knife swab (93%). Poor personal hygiene and insufficient cleaning of butcher knife and wooden block resulted in higher count of *Escherichia coli* and *Staphylococcus aureus*. Such pathogens can be transferred on raw chicken while handling, slaughtering or cutting. Therefore food handlers, knife and wooden cutting surface can be considered as potential source of microbial hazard of slaughtering process followed in retail poultry shop. Considering huge consumption of retail chicken by population and to achieve global food safety, effective safety system shall be developed for retail level of slaughtering which will help to reduce microbial contamination of raw chicken.

Key words: Raw chicken, food contact surfaces, swab samples, *E.coli*, *S. aureus*, contamination source.

**INTRODUCTION**

Freshly slaughtered chicken sold at retail level is preferred by consumer worldwide. Slaughtering process used in this level is traditional and has number of gaps which can initiates the cross contamination of raw chicken meat while slaughtering as well as while handling [1]. To know the prevalence of pathogen in raw chicken,number of studies were carried out. In Bangalore (India), 65.71% of *S. aureus* and 85.72% of *E.coli* was found in samples collected from retail outlets[2]. 65% samples found contaminated

with *S. aureus* collected from retail market Tabriz, Iran [3]. Strains of Antibiotic resistant *E.coli* was isolated form raw chicken sold in retail market of Vietnam [4]. In Nairobi (Kenya), 78% *E.coli* was found in raw chicken sample out of which 60.3% *E.coli* isolates were resistance to tetracycline antibiotic [5].

On the other side, few researchers talks about relation between hygienic conditions of retail shop and microbial prevalence in raw chicken. Study was design to evaluate bacterial quality of chicken and comparison of the result based on the level of contamination form 4 different types of shops. From each type of shop, 24 samples were collected and analyzed *E. coli* and *S. aureus*. 2.34 ,2.32, 1.81, 0.70 *E.coli* count found in popular shop, slaughter house, poultryer's shop and supermarket respectively. Likewise 2.43, 2.42, 0.87, 0.68 *S. aureus* count found in popular shop, slaughter house, poultryer's shop and supermarket respectively. As the level of hygienic conditions is increasing, there is decrease in the *E. coli* and *S. aureus* count in samples. Therefore samples from supermarket having less prevalence of pathogens than samples from other type of shop [6]. Some studies focuses on microbial quality of environment provided in food processing area. In Kota Bharu (Kelantan), study was carried out to know microbial status of environmental hygiene of school canteen. Out of 90 hand swabs were collected of food handers, 40 swabs were found contaminated with *S. aureus*. Equal contamination was also observed on swabs of chopping boards and swabs of knife. This shows that food handler can become source of contamination and there is a need for effective personal hygiene sanitation training for food handlers [7]. In Iran, hand swabs were collected to check the presence of microbes. This showed predominance of *E.Coli* (22%) followed by *S.aureus* (12.3%) on swab samples [8].

Based on the review, it is clear that raw chicken is contaminated with number of pathogens out of which *E.coli* and *S. aureus* are most common spoilage causing bacteria. Few study also speaks about presence of these pathogen on hand swabs, chopping boards and knife. Hence to identify sources of these common pathogen, microbial quality of three food contact surfaces like hand swab of food handlers, swab of butcher knife and swab of wooden block used for portioning were analyzed.

## MATERIAL AND METHODS

**Sample selection:** To identify most frequent raw chicken contact surfaces, survey and observation was carried out in 10 shops. This survey was focusing on slaughtering practice followed in the shop. Based on observation, Knife, cutting surface and food handler were identified as most frequent direct food contact surfaces. Hence these swab samples were collected of the same form sixty retail shops.

### **Sample collection:**

**Hand swab:** From each shop, hand swabs were taken from 3 different days of same person/worker and mean of three obtained count was calculated. Sterilized swab tube were used. Swabs were collected from both hands of worker specifically finger tips. After labelling it was kept in ice box.

**Knife swab:** From each shop, knife swabs were taken from 3 different days and mean of three obtained count was calculated. Sterilized swab tube were used. Swabs were collected from both sides of knife specifically area which comes in contact with chicken frequently. After labelling it was kept in ice box.

**Swab from cutting surface area:** From each shop, cutting surface swabs were taken from 3 different days and mean of three obtained count was calculated. Sterilized swab tube were used. Swabs were collected by rolling bud on cutting surface specifically area which comes in contact with chicken frequently.

All the collected samples were sent to the Poultry Diagnostic and Research Centre (PDRC) laboratory within 2 hours after collection. This laboratory has received recognition from the Export Inspection Council of India, Ministry of Commerce and Industry – Govt. of India and Agriculture and Processed Food Products Exports Development Authority (APEDA) – Govt. of India as a testing laboratory for antibiotic and pesticide residue in food products meant for export.

Microbial parameters: All samples were tested for presence and count of *Escherichia coli* and *Staphylococcus aureus* using IS 5887 (part 1) [9] and IS 5887 (part 2) [10] test method.

## RESULT

In total, 180 samples were analyzed for quantitative presence of *Escherichia coli* out of which 138 samples found positive. While considering highest percent prevalence was observed in Knife swab samples i.e. 88.3% followed by cutting surface swab (73.33%) and hand swab (68.3%) (refer table 1). *E.coli* count in the form of CFU is presented in table 1. In case of *S.aureus*, 173 out of 180 samples found positive. All 60 samples of hand swab found contaminated with coagulase positive *S. aureus* with  $6.8 \times 10^4$  +/- 1.58 SD CFU/g. Cutting surface swab (95%) and Knife swab (93%) found positive for the same pathogen (refer table 2).

Table 1: Summary of *E.coli* count in swab sample

Sample	number of samples found contaminated out of 60	Mean +/- S.D	Range (CFU/g)	Percent sample contaminated
Hand swab	41	$6.8 \times 10^4$ +/- 1.58	$0.001 \times 10^5$ to $5.3 \times 10^5$	68.3%
Knife swab	53	$7.1 \times 10^7$ +/- 1	$0.001 \times 10^5$ to $2.66 \times 10^5$	88.3%
Cutting surface swab	44	$2.21 \times 10^5$ +/- 2.28	$0.0093 \times 10^5$ to $6.3 \times 10^5$	73.33%

Table 2: Summary of *S. aureus* count in swab samples

Sample	number of samples found contaminated out of 60	Mean +/- S.D	Range (CFU/g)	Percent sample contaminated
Hand swab	60	$9.3 \times 10^4$ +/- 1.30	$0.005 \times 10^5$ to $3 \times 10^5$	100%
Knife swab	56	$1.80 \times 10^8$ +/- 1.74	$0.004 \times 10^5$ to $5.3 \times 10^5$	93%
Cutting surface swab	57	$1.18 \times 10^5$ +/- 1.48	$0.015 \times 10^5$ to $4.66 \times 10^5$	95%

## DISCUSSION

Present study was carried out to identify significant source of contamination in retail slaughtering process. Hence most common food contact surfaces were selected. While conducting this study, not only microbial analysis was carried out but also few observations were made related to personal hygiene, cleaning practices and meat handling. It showed that, food handlers were not washing hands after handling meat or after visiting toilets. Hand wash basin was not provided in the shop. No specific job was allotted to the workers which resulted in handling of live stock, slaughtered meat and washed raw chicken by same person i.e. possible chances of cross contamination of raw chicken. Such practices are responsible for high percentage of *E.coli* (68.5%) and *S. aureus* (100%) contamination of hand swabs. In case of cutting surface, wooden block was only scaped by metal scraper to facilitate cleaning. This scrapping was only able to remove stuck meat pieces and not sufficient to reduce microbial load. In addition to this, fly activity was also observed near such wooden block due to presence of blood. All such practices were contributed in 73% and 95% prevalence of *E.coli* and *S. aureus* respectively. Butcher knife used for portioning and cutting of raw chicken was not washed regularly due to its ability to develop rust. Also it was placed on any surface after use which can contribute in pathogenic load on the surface of knife.

Based on obtained result and observations, it can be concluded that heavy microbial contamination specifically *E.coli* and *S. aureus* was found on selected food contact surfaces. These pathogens are responsible for food borne illness. Therefore food handlers, butcher knife and wooden cutting surface needs to be considered as potential source of microbial hazard of slaughtering process followed in retail poultry shop. Considering huge consumption of retail chicken by population and to achieve global food safety, effective safety system shall be developed for retail level of slaughtering which will help to reduce microbial contamination of raw chicken.

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## REFERENCES

- [1] Qureshi, I. A. (1999) Chicken meat: A protective food which must be safe guarded against contamination. *Economic Review* 8: 25-29.
- [2] Badhe, S.K., Falroze, M.N. and Sudarshan, S. (2013) Prevalence of food borne pathogens in markets samples of chicken meat in Bangalore, India. *Indian J Anim. Res*, 47(3): 262-264.
- [3] Javadi, A., Safarmashaei S. (2011) Microbial Profile of Marketed Broiler meat. *Middle East Journal of Scientific Research* 9(5), Page no 652-656.
- [4] Houg, C.T., Duong, N.T., Hain, N.T. (2009). Contamination of some bacteria isolated from chicken meat in retail market in Hanoi and examination of the antibiotic resistance ability of *Salmonella* and *E.coli* strains isolated. *Journal of Science Development* 7 (english issue 2), page no 181-186.
- [5] Odwar, J.A et al (2014). A cross sectional study on the microbiological quality and safety of raw chicken meats sold in Nairobi, Kenya. *BMC research notes*: 10.1186/1756-0500-7-627.
- [6] Chaiba, A. et al (2007). Microbial quality of poultry meat on the Meknes market (Morocco). *Internet Journal of Food Safety*, volume 9. pg no 67-71.

- [7] Nik Rosmawati et al. (2014). Evaluation of Environmental Hygiene and Microbiological status of selected primary school canteen. Health and the Environment Journal, 2014 volume 5, no.3. Page no. 110-127.
- [8] Shojaei, H., Shooshtaripoor, J., & Amiri, M. (2006). Efficacy of simple hand-washing in reduction of microbial hand contamination of Iranian food handlers. Food research international, 39(5), 525-529.
- [9] IS 5887, part 1 (1976) Methods for detection of bacteria responsible for food poisoning. Isolation, Identification, enumeration of E. coli.
- [10] IS 5887, part 2 (1976) Methods for detection of bacteria responsible for food poisoning. Isolation, Identification, enumeration of Staphylococcus aureus.