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Research Paper

PREVALENCE OF PATHOGENS IN RAW CHICKEN SOLD AT RETAIL POULTRY SHOPS IN PUNE CITY, INDIA

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Abstract

Sixty raw chicken samples were collected from sixty deferent retail outlets to check the prevalence of pathogen. Samples were analyzed for presence of *E.coli, S.aureus, Salmonella* and *Clostridium prefringenes* . As per the report,*S. aureus (76.6%)* was foundfollowed with *E.coli (61.11%)*, *Clostridium (60%)* and *Salmonella (30%)* in the sample. High incidence of *S. aureus* and *E.coli* are the indicator of poor personal hygiene and poor cleaning practices. Whereas presence of Clostridium and Salmonella indicates, poor waste disposal practices and cross contamination of carcass by bird dropping and eviscerated parts. These results highlights the need for maintaining good hygienic practices and effective flock management at retail shop. To ensure food safety nationally, it is important to consider retail level food production along with commercial food industries. As far as chicken slaughtering is concerned, only 5% chicken is slaughtered at industrial level and remaining is slaughtered at retail poultry shops. Hence considering the higher percentage of retail level chicken slaughtering and the obtained results of the present study, retail slaughtering system needs to be upgraded by providing process guideline and owner's education. Such progressive steps will help to achieve safety of raw chicken by reducing pathogen load on raw chicken.

Key words: Raw *chicken microbial quality*, *E.coli, S.aureus, Salmonella,Clostridium, Food safety*.

INTRODUCTION

Awareness regarding food safety among consumers in increasing day by day. But exact meaning of safety is not clear. Food safety refers to chemical, physical and microbial quality of raw and processed foods. Microbial quality is related to presence or absence of food born pathogens in the product. In non vegetarian products, risk of microbial contamination is higher than in vegetarian sources because of the composition of food. Chicken is one of the popular foods among non vegetarian foods. In India, chicken is slaughtered at both industrial as well as at

retail level. However only 5% chicken is slaughtered at industrial level, while the remaining is slaughtered at retail level[1].

At industrial level, HACCP and/ or different types of food safety systems are followed which ensures the safety of raw chicken and its products. However, such systems are not followed at retail level and therefore probability of cross contamination of raw chicken increases due to poor slaughtering practices, poor personal hygiene and poor cleaning practices followed in retail shops [2].

Several studies from different countries have reported presence of pathogens in the raw chicken samples collected from retail outlets. In Bangalore (India), 280 chicken breast and thigh samples were analyzed to check the presence of pathogens.The researcheralso evaluated infrastructure, food handling practices followed in non sophisticated outlets with minimum facilities (NS), moderate facility outlets with separate units for slaughtering (MF), sophisticated outlets (SOF) and poultry processing outlets (PP). Results revealed that *S.typhi* (68.57%), *E.coli* (87.14%)and *S.aureus* (100%) was found in samples from NS category and as the level of sophistication in the facilities increased the presence of contamination decreased[1]. In Poundechuty, samples were collected from retail chicken shops as well as from scientific chicken slaughtering unit. Researcher reported that chicken samples collected from retailers had higher count TPC (6.35%), coliform (4.97%) than was found in the chicken samples from scientific slaughtering units i.e. TPC (3.03%), coliform (2.36%)[3]. In Nepal, 12 of 26 samples (46.15%) were found to be contaminated with *Salmonella*[4]. Where as in Lahore (Pakistan), 35%, 45% and 55% samples had*Salmonella*, *E.coli*and *S. aureus*respectively[5]. Prevalence of *Clostridium* was reported 83% in Tabriz, Iran [6] and 12.80% in Ontario[7].

Further, many detected pathogens were reported to be drug resistance. In Japan, multi drug resistance strains of E coli and Salmonella has been reported[8].In Vietnam, *Salmonella and E coli* isolated from chicken samples showed resistance against streptomycin, Sulphonamide, Neomycin, Sulphamethoxazole, Gentamicin, Ampicillin , Colistin and ciprofloxacin[9]. Such studies spotted the potential role of retail chicken meat in dissemination of multi drug resistant food born bacteria. Food born disease outbreaks caused by *Campylobacter, E. coli* which were isolated from chicken samples were also reported in Lithuania and U.S respectively [10] [11].

On this background, current study was carried out to understand the microbial quality with the focus on prevalence of pathogens in raw chicken sold at retail poultry shops of Pune.

MATERIAL AND METHODS

The study was carried out from June 2014 till February 2015.

Sample selection:

Pune is divided into 15 municipal wards. These wards were taken as criteria to select representative sample. From each ward, 4 retail venders were randomly selected for sampling. All samples were collected in morning session between 11 am and 12.30 pm.

Procurement of chicken samples:

From selected shops, 500g freshly slaughtered raw chicken was purchased and transferred to sterilized bag. After sealing and labelling, the bag was transported in ice box to the Poultry Diagnostic and Research Centre (PDRC) laboratory with in 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 parameter:

All samples were tested for following parameters:

1.Total Plate Count(TPC): IS 5402 test method [12]
2.Coliform: IS 5401 (part 1) test method [13]
3.*E.coli*: IS 5887 (part 1)test method [14]
4.*Staphylococcus aureus:* IS 5887 (part 2)test method [15]
5.Salmonella: IS 5887 (part 3)test method [16]
6.*Clostridium perfringens:* IS 5887 (part 4)test method [17]

RESULT

I. **Microbial quality of sample based on TPC and indicator organisms (Coliform)**

TPC: Total plate count ranged from 0.00004 x 10^8 to 7 x 10^8 CFU/g and average is 6.866 x 10^8 CFU/g.Total plate count is the measure of overall microbial quality of sample and help to know microbial load in sample. As per FDA Philippines[22], TPC shall be less than 5 x 10^5 . Obtained values are exceeding the limit.

Coliform: This count ranged from 0.0002 x 10^7 to 8 x 10^7 CFU/g and average is 1.764 x 10^7 CFU/g.The coliform count refers to indicator organisms which indicates fecal contamination [18], [19]. Coliform count includes pathogenic as well as non pathogenic coliform. This group of bacteria is contributed through water.

The results of microbial analysis are shown in table1.

II. **Microbial quality of sample based on presence of pathogens**

E. coli: Detection of E.coli is the measure of hygienic conditions followed in processing area and water quality in relation with fecal contamination. E.coli was present in 37 out of 60 samples i.e. 61.11%. This count was ranged from 0.0004 x 10^6 to 90 x 10^6 CFU/g and average is 8.596 x 10^6. This percentage is less than 87.14% found in Bangalore study[1] and more than 45% found in Lahore city, Pakistan[5].

Staphylococcus aureus: This pathogen act as an indicator of personal hygiene of food handlers. This was present in 46 out of 60 samples i.e. 76.66%. The count was ranged from 0.02 x 10^4 to 30 x 10^4 CFU/ g and average is 1.46 x 10^4. Coagulase test was also conducted. All observed S. aureus were found Coagulase positive. This coagulase positive S. aureus is considered as potential hazardous and indicates serious food safety concern [18].

Clostridium perfringens: This is toxic producing bacteria and can lead to food poisoning to consumer. This pathogen was present in 36 out of 60 samples i.e. 60%. 0.02 x 10^3 to 6 x 10^3 CFU/g and average is 2.11x 10^3 CFU/g. Percent prevalence of this pathogen is far more than obtained in Ontario i.e. 12.80%[7].

Salmonella: This pathogen can come in contact with food from environment, contaminated water and from cold blooded and worm blooded animal. This is commonly found in food from animal origin. This pathogens was in 18 out of 60 samples i.e. 30% , with range of 1 x 10^2 to 4 x 10^2 CFU/g and average is 0.60 x 10^2.

Table 1: Summary of microbial quality of raw chicken samples

Microbial parameters	number of samples found contaminated out of 60	Mean with SD	Range of microbial count in samples (CFU/g)	Percent prevalence
TPC	**60**	**6.866 x 10^8 +/- 13.63**	**0.00004 x 10^8 to 7 x 10^8**	**100%**
Coliform	**60**	**1.764 x 10^7 +/- 7.80**	**0.0002 x 10^7 to 8 x 10^7**	**100%**
E.coli	**37**	**8.596 x 10^6 +/- 66.87**	**0.0004 x 10^6 to 90 x 10^6**	**61.11%**
S. aureus	**46**	**1.46 x 10^4 +/- 4.57**	**0.02 x 10^4 to 30 x 10^4**	**76.66%**
Clostridium	**36**	**2.11 x 10^3 +/- 1.72**	**0.02 x 10^3 to 6 x 10^3**	**60%**
Salmonella	**18**	**6 x 10^1+/- 1.01**	**1 x 10^2 to 4 x 10^2**	**30%**

DISCUSSION

While sampling, few practices were observed which were followed in the shop related to Bird cages, hand washing, waste disposal, post slaughtering carcass handling and storage. Observed practices are described below,

Bird cages: Cages in which birds are placed were not provided with tray after each stepwise section.Hence there was not proper collection of bird dropping resulted in falling of bird dropping on the other birds. If trays were placed after each section of cage then collection of bird droppings was possible. *Clostridium, Salmonella* are present in Bird feces, on feathers. Due to improper collection of the dropping can result in cross contamination of raw chicken with *Clostridium, Salmonella*[20].

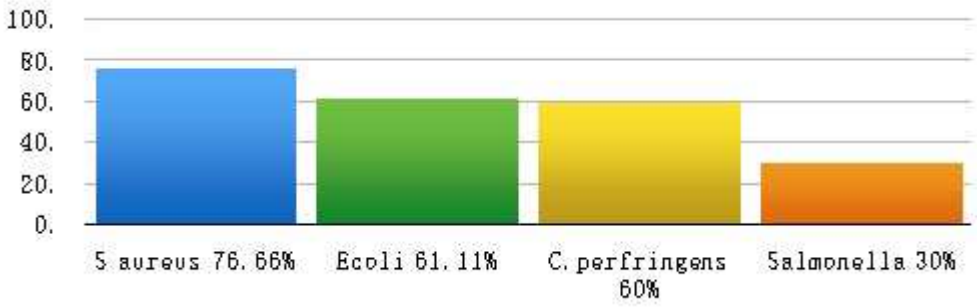
Hand washing: Out of 60 shops, soap and wash basin was provided in only 2 shops. In the remaining shops, food handlers were not following the hand washing practice. Hence lack in this important practice can result in cross contamination of chicken with E.coli as well as S.aureus [19].

Waste disposal: Intestine of bird carry large number of bacteria and some of these bacterias causing food borne illness to the human being[20]. Such eviscerated parts of birds were collected and stored in open waste bin for more than 12 hours in shop. This could lead in increased chances of cross contamination of chicken.

Post slaughter handling: After washing with water, chicken was stored at room temperature till its sale and It is cut or portioned on the wooden block. Unsatisfactory cleaning practices of this wooden block can result in increased microbial load on the block. Such practices can lead to cross contamination of raw chicken.

Considering above mentioned practices followed in the shop, probability of cross contamination of raw chicken while handling can increase. Malpractices can lead to food born diseases which is a public health issue.

Chart1: Percent prevalence of pathogen in raw chicken samples



CONCLUSION

Different countries have established their own microbial specification for raw/ fresh poultry meat which is as follows (table 2).

Above mentioned standards and Meat industrial guide 2015 UK [20] also state that Salmonella shall be absent in 25g.

When obtained microbial count was compared with standard microbial count, it highlights that all the microbial count of raw chicken samples excessed than the standard count. Hence present study revealed that, microbial quality of raw chicken slaughtered at retail level in Pune is not satisfactory and can affect health of the consumer. Isolated pathogens are responsible for food born illness like gastro-enteritis caused by *E.coli*, salmonellosis and typhoid caused by *Salmonella,*food poisoning due to production of enterotoxin A toxin by *S. aureus* and *C. perfringens*[25].

Other than above discussed practices, fly activity, poor personal hygiene, spitting practices and open water storage contributes to contamination of raw chickens. Therefore to improve overall hygienic conditions at retail poultry shops, owners shall refer the guidelines given in FSSAI schedule IV [18].To improve microbial quality and safety, specific food safety system shall be

developed for retail level poultry shops . Microbiological parameters for raw chicken and chicken products shall be specified in FSSAI which can help to control level of contamination in freshly slaughtered chicken.

Table 2: Summary of microbiological standard of raw chicken by various agencies

Name of Country	Paramenters	Limits
New Zealand standard: (October 1995) [21]	Faecal coliform	10^2
FDA Philippines: (February 2013) [22]	APC/SPC	5×10^5
Thai agricultural standard (2005)[23]	TPC	5×10^5
	Coliform	5×10^3
	S. aureus	1×10^2
Hong Kong (August 2014)[25]	ACC	$< 10^4$
	E. coli	Nil
	S.aureus	< 20
	Clostridium perfriengen	< 10

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