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P Vasanth Kumar

M.V. Sc Scholar, Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Sujatha Singh

Assistant Professor, Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

N Krishnaiah

Professor & Head, Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

M Shashi Kumar

Professor & Head, Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

B Kala Kumar

Professor & Head, Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Corresponding Author

P Vasanth Kumar

M.V. Sc Scholar, Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana, India

Microbiological quality of chicken sold in and around greater Hyderabad municipal corporation

P Vasanth Kumar, Sujatha Singh, N Krishnaiah, M Shashi Kumar and B Kala Kumar

Abstract

To study the microbiological quality of chicken sold in and around Greater Hyderabad Municipal Corporation by estimating i.e Total viable count, Total coliform count, Faecal coliform count, and yeast and mould counts. Samples collected from three different sources i.e Large scale processing centers, Hygienically maintained chicken shops and Road side vendors of 150 samples each source 100g quantity, packed in self-sealed sterilized polyethylene bags with appropriate labeling. The samples were kept at refrigeration temperature till further analysis. The mean Total viable counts in the chicken samples from Large scale processing centers, Road side slaughtering stalls, Hygienically maintained chicken shops were $4.43 \times 10^5 \pm 0.38 \times 10^5$ CFU/gm, $6.53 \times 10^6 \pm 0.86 \times 10^6$ CFU/gm and $3.86 \times 10^7 + 1.08 \times 10^7$ CFU/gm respectively. The mean Total Coliform counts in the chicken samples from Large scale processing centers, Road side slaughtering stalls, Hygienically maintained chicken shops were $2.18 \times 10^4 \pm 0.46 \times 10^4$ CFU/gm, $8.93 \times 10^4 \pm 0.41 \times 10^4$ CFU/gm and $5.68 \times 10^5 + 0.36 \times 10^5$ CFU/gm respectively. The mean faecal Coliform counts in the chicken samples from Large scale processing centers, Road side slaughtering stalls, Hygienically maintained chicken shops were $9.86 \times 10^3 \pm 0.41 \times 10^3$ CFU/gm, $1.28 \times 10^4 \pm 0.49 \times 10^4$ CFU/gm and $2.38 \times 10^5 + 0.47 \times 10^5$ CFU/gm respectively. The mean Yeast and Mould count is in the chicken samples from Large scale processing centers, Road side slaughtering stalls, Hygienically maintained chicken shops were $1.36 \times 10^3 \pm 0.38 \times 10^3$ CFU/gm, $3.86 \times 10^4 \pm 0.45 \times 10^4$ CFU/gm and $4.38 \times 10^5 + 0.50 \times 10^5$ CFU/gm respectively. Chicken may be purchased from the large scale and hygienically maintained chicken shops as the microbial counts are low and awareness created not to purchase the chicken from road side slaughter stalls to avoid public health hazards.

Keywords: Chicken-different shops-microbial quality-GHMC-public health awareness

Introduction

In recent times, Poultry industry is growing rapidly in India due to high rate of urbanization and changed food consumption pattern. Large scale operations making it hygienic and economic aspects role in processing, however in semi-urban and rural areas the poultry supply chain is operated at small scale with increased risk of microbial hazards. A typical retail chicken meat shop operations comprise of maintenance of live birds, slaughtering, dressing and marketing. Very often the operations are being done, by traditional methods without application of hygiene, maintenance, scientific methodologies and technique (Sakia and Joshi, 2010) [33-24].

Meat is an important edible postmortem component originating from the animals that are used as food. The increasing demand for animal proteins, like meat and meat products, has increased the load of slaughterhouses resulting in inadequate attention being paid to the hygienic aspect of meat production. The muscle tissues obtained from the healthy birds slaughter is usually sterile although, freshly slaughtered birds may harbor few bacteria. However, during the process of converting live bird into meat, microbial contamination of carcass surface is unavoidable (Mawia *et al.*, 2012) [27]. In India, temperature and humidity are ideal for growth and survival of micro-organisms (Chaubey *et al.*, 2004) [12]. Hot climate and lack of proper storage facilities render chicken vulnerable to spoilage, thus posing risk to consumers. Many pathogens like *E. coli*, *S.aureus*, *Salmonella spp*, *Clostridium spp*, *Listeria spp*, *Campylobacter spp* etc. have been isolated in many of the food borne diseases outbreaks through chicken and its products that affects public health.

In India, only 10% of the chicken meat is coming from organized sector, where as 90% are slaughtered and sold in street vendor shops. In most of the chicken retail shops, the sanitary and hygienic conditions are not up to the expected conditions, even it will be in worsen

conditions, especially in Road side vendors. The absence of Organized poultry slaughter houses under Indian conditions is the main reason for poor quality of chicken in the markets. To maintain low microbial load of chicken, application of HACCP is practiced in Large processing centers, but in smaller chicken outlets due to negligence and lack of infrastructure, it is not practiced (Darshana *et al.*, 2014) [15]. There is no systematic study, about the quality of chicken sold in different type of chicken outlets in and around Greater Hyderabad Municipal Corporation, Hyderabad, hence the present study was undertaken.

Materials and Methods

The study was conducted in the laboratory of Veterinary public Health and Epidemiology, College of Veterinary Science Rajendranagar, Hyderabad. Meat samples from three sources i.e Large scale processing centers, Hygienically maintained chicken shops and Road side vendors of 150 samples each source 100g quantity, packed in self sealed sterilized polyethylene bags with appropriate labeling. The samples were kept at refrigeration temperature till further

analysis.

Results and Discussion

The results of the present study are in mentioned in Table No.1. The mean Total viable count in the chicken samples from Large scale processing centers was low ($4.43 \times 10^5 \pm 0.38 \times 10^5$ CFU/gm) ranging from 8.9×10^4 - 2.6×10^6 CFU/gm and highest in chicken samples collected from street vendors was $3.86 \times 10^7 \pm 1.08 \times 10^7$ CFU/gm ranging from 8.3×10^6 - 9.3×10^7 CFU/gm, whereas the samples from Hygienically maintained chicken shops was $6.53 \times 10^6 \pm 0.86 \times 10^6$ CFU/gm, ranging from 1.3×10^5 - 5.6×10^7 CFU/gm. The total viable count in the chicken from Large scale processing centers in the present study (4.43×10^5) was almost similar to the counts of 3.2×10^5 , 5.8×10^5 , 2.9×10^5 , 3.9×10^5 , 2.1×10^5 , 3.5×10^5 , 1.9×10^5 , 3.6×10^5 and 5.0×10^5 CFU/gm reported by Sawant (1986) [35], Dhanze *et al.* (2012) [16] from palampur, Gupta and Gupta (2009) [18], Amara *et al.* (1994) [5], Yashodha *et al.* (2001), Izat *et al.* (1989) [22], Mead *et al.* (1993) [28], Jerri *et al.* (2015) from Nigeria and Sakia and Joshi (2010) [33-24] from North east states in India respectively.

Table 1: Microbial counts (CFU/gm) in chicken samples collected from three sources.

S. No	Particulars	Large scale processing centers	Hygienically maintained chicken shops	Road side slaughtering stalls
1	Total viable count mean (Range)	$4.43 \times 10^5 \pm 0.38 \times 10^5$ (8.9×10^4 - 2.6×10^6)	$6.53 \times 10^6 \pm 0.86 \times 10^6$ (1.3×10^5 - 5.6×10^7)	$3.86 \times 10^7 \pm 1.08 \times 10^7$ (8.3×10^6 - 9.3×10^7)
2	Total coliform count mean (Range)	$2.18 \times 10^4 \pm 0.46 \times 10^4$ (5.6×10^3 - 3.8×10^5)	$8.93 \times 10^4 \pm 0.41 \times 10^4$ (6.3×10^3 - 1.3×10^5)	$5.68 \times 10^5 \pm 0.36 \times 10^5$ (8.9×10^4 - 1.3×10^6)
3	Total faecal coliform count mean (Range)	$9.86 \times 10^3 \pm 0.41 \times 10^3$ (2.3×10^3 - 4.2×10^4)	$1.28 \times 10^4 \pm 0.49 \times 10^4$ (7.8×10^3 - 1.2×10^5)	$2.38 \times 10^5 \pm 0.47 \times 10^5$ (8.9×10^4 - 1.3×10^6)
4	Total yeast and mould count mean (Range)	$1.36 \times 10^3 \pm 0.38 \times 10^3$ (0.8×10^3 - 8.3×10^3)	$3.86 \times 10^4 \pm 0.45 \times 10^4$ (9.1×10^3 - 8.6×10^4)	$4.38 \times 10^5 \pm 0.50 \times 10^5$ (8.6×10^4 - 1.3×10^6)

Total viable counts of 9.1×10^5 , 6.3×10^5 , 6.3×10^5 , 7.9×10^5 and 8.6×10^5 CFU/gm in chicken samples which were slightly higher than the present count from Large scale processing centers (4.43×10^5) were reported by omorodin and odu (2014) [31], Heetun *et al.* (2015) [19], Alvarez-Astroga *et al.* (2002), Cohen *et al.* (2007) [13] and Omorodin and odu (2014) [31] respectively, whereas very high counts of 3.9×10^6 - 1.5×10^7 , 2.6×10^6 and 2.5×10^6 CFU/gm were reported by Amara *et al.* (1994) [5], Omorodin and odu (2014) [31] and Rashad (1990) [32] respectively.

The total viable count in the chicken from Hygienically maintained chicken shops in the present study was 6.53×10^6 CFU/gm, which was almost similar to the counts of 5.74×10^6 , 1.6×10^6 , 1.5×10^6 , 1.6×10^6 , 2.4×10^6 , 3.9×10^6 , 4.3×10^6 , 4.3×10^6 , 3.9×10^6 , 4.6×10^6 , 3.7×10^6 , 2.4×10^6 CFU/gm reported by Obeng *et al.* (2013) [30], kumar *et al.* (2012), Ibrahim *et al.* (2015) [21] commercial retail shops in Benisuef city, Santhosh kumar *et al.* (2012), Senugupta *et al.* (2012), Abu-Ruwaida *et al.* (1994) [1], Mawia *et al.* (2010), Santhosh kumar *et al.* (2011), Cohen *et al.* (2007) [13], Joshi and Joshi (2010) [33-24], Sakia and Joshi (2010) [33-24] local meat markets of North east India and Kumar *et al.* (2011).

Total viable Counts of 6.5×10^7 and 2.7×10^4 - 2×10^8 CFU/gm, which were higher than the present count from Hygienically maintained chicken shops were reported by Tesfay *et al.* (2014) and Erdem *et al.* (2014) Butcher shops and super markets in Isthambul. The total viable count in the chicken from Road side slaughtering stalls in the present study was 3.86×10^7 CFU/gm which was almost similar to the counts of 3.5×10^6 , 1.4×10^7 , 2.1×10^7 , 1.7×10^7 , 1.6×10^7 and 1.8×10^7 CFU/gm reported by Amara *et al.* (1994) [5], Barbudde *et al.*

(2003) [8], Bhandari *et al.* (2013) [9], Ahmad *et al.* (2013) [3] retail out lets in Lahore, Sakia and Joshi (2010) [33-24] from local small chicken shops of north east India respectively.

Total viable Counts of TVC 4.6×10^8 , 3.1×10^{11} , 1.2×10^{11} , 1.4×10^{10} , 6.8×10^8 CFU/gm, which were higher than the present count from Road side slaughtering stalls were reported by Afolabi *et al.* (2017) [2], Bhandari *et al.* (2013) [9], Huang *et al.* (2009) [20], Bohara (2017) [10] local meat markets of Kanchanpur Districts, Nepal, Vaidya *et al.* (2016) [37] retail outlets in pune respectively.

Total coliform count

The mean total coliform count in the chicken samples from Road side slaughtering stalls was $5.68 \times 10^5 \pm 0.36 \times 10^5$ CFU/gm ranging from 8.9×10^4 - 1.3×10^6 CFU/gm, which was very high compared to the counts from Large scale processing centers and hygienically maintained chicken shops. The mean total coliform count in chicken samples Collected from Large scale processing centers was less ($2.18 \times 10^4 \pm 0.46 \times 10^4$ CFU/gm) ranging from 6.3×10^3 - 1.3×10^5 CFU/gm, where as the counts were in between the other two sources ($8.93 \times 10^4 \pm 0.41 \times 10^4$ CFU/gm) ranging from 6.3×10^3 - 1.3×10^5 CFU/gm.

The total coliform count in the chicken from Large scale processing centers was 2.18×10^4 CFU/gm which was similar to the counts of 1.2×10^4 , 9.3×10^4 , 1.2×10^4 - 7.9×10^4 CFU/gm reported by Dhanze *et al.* (2012) [16] retail outlets palampur, Santhosh kumar *et al.* (2012), Abu-Ruwaida *et al.* (1994) [1] respectively.

Total coliform Counts of 6.4×10^1 , 1×10^2 , 1.1×10^2 , 5.0×10^2 , 3.9×10^2 and 1.3×10^1 CFU/gm, which were lower than the counts of Large scale processing centers in the present

study was reported by Daoud *et al.* (2012), Kumar *et al.* (2012), Ibrahim *et al.* (2015) [21] commercial retail shops in Benisuef city, Capita *et al.* (2002) [4], North cutt *et al.* (2003) and Selvan *et al.* (2007) respectively. The total coliform count in the chicken from Hygienically maintained chicken shops in the present study was 8.93×10^4 CFU/gm, which was almost similar to the counts of 9.3×10^4 and 7.9×10^4 CFU/gm reported by Kumar *et al.* (2012) and AbuRuwaida *et al.* (1994) respectively.

Total coliform Counts of 1.0×10^1 , 8.3×10^2 , 1.2×10^3 , 6.3×10^3 , 6.4×10^3 , 9.3×10^3 and 3.2×10^3 CFU/gm, which were lower than the counts of Hygienically maintained chicken shops in the present study was reported by Joshi and Joshi (2010) [33-24], Chaudrya *et al.* (2011), Izat *et al.* (198 9) [22], Mead *et al.* (1993) [28], Mawia *et al.* (2012) [27], Azage and kibret (2017) [6] and Senugupta *et al.* (2012) respectively. The total coliform count in the chicken from Road side slaughtering stalls was 5.68×10^5 CFU/gm which was similar to the counts of 10^1 - 10^6 , 1.3×10^5 and 7.0×10^5 CFU/gm reported by Bananna *et al.* (2016) traditional shops of chicken at Zuwalah, Libya, Kumar *et al.* (2012) and Mukopadhyay *et al.* (2004) respectively.

Total coliform Counts of 3.6×10^6 , 4.5×10^7 and 1.7×10^7 CFU/gm, which were higher than the counts of Road side slaughtering stalls in the present study was reported by Bhandari *et al.* (2013) [9], Erdem *et al.* (2014) Butcher shops and super markets in Isthambul and Vaidya *et al.* (2016) [37] retail outlets (Pune) respectively.

Feecal coliform count

The mean Feecal coliform count in the chicken samples from Road side slaughtering stalls was $2.38 \times 10^5 \pm 0.47 \times 10^5$ CFU/gm ranging from 8.9×10^4 - 1.3×10^6 CFU/gm. which was very high compared to the counts from Large scale processing centers and hygienically maintained chicken shops. The mean Feecal coliform count in chicken samples collected from Large scale processing centers was less ($9.86 \times 10^3 \pm 0.41 \times 10^3$ CFU/gm) ranging from 2.3×10^3 - 4.2×10^4 CFU/gm, where as the Hygienically maintained chicken shops counts were in between the other two sources ($1.28 \times 10^4 \pm 0.49 \times 10^4$ CFU/gm) ranging from 7.8×10^3 - 1.2×10^5 CFU/gm.

The Feecal coliform count in the chicken from Large scale processing centers (9.86×10^3 CFU/gm) was similar to the count of 3.9×10^3 CFU/gm reported by Cohen *et al.* (2007) [13]. Feecal coliform Count of 9.3×10^4 CFU/gm which was higher than the counts of Large scale processing centers in the present study (9.86×10^3 CFU/gm) was reported by Kumar *et al.* (2012).

Feecal coliform Counts of 4.9×10 , 1×10^2 , 1.1×10^2 and 3.9×10^2 CFU/gm which were lower than the counts of Large scale processing centers in the present study (9.86×10^3 CFU/gm) was reported by Daoud *et al.* (2012), Kumar *et al.* (2012), Ibrahim *et al.* (2015) [21] commercial retail shops in Benisuef city, and Cohen *et al.* (2007) [13] respectively. The Feecal coliform count in the chicken from Hygienically maintained chicken shops was 1.28×10^4 CFU/gm which was similar to the count of 1.2×10^4 CFU/gm reported by Dhanze *et al.* (2012) [16]. Feecal coliform Counts of 6.3×10^3 CFU/gm which was lower than the counts of Hygienically maintained chicken shops in the present study (1.28×10^4) was reported by Cohen *et al.* (2007) [13].

Feecal coliform Counts of 1.8 - 5.3×10^6 CFU/gm which was higher than the counts of Hygienically maintained chicken shops (1.28×10^4) was reported by Kumar *et al.* (2011). The Feecal coliform count in the chicken from Road side

slaughtering stalls was 2.38×10^5 CFU/gm, which was almost similar to the counts of 1.3×10^5 and 7.0×10^5 CFU/gm reported by Kumar *et al.* (2012) and Mukopadhyay *et al.* (2004) respectively. The Feecal coliform count in chicken meat indicates the extent of exposure of the carcass to the feecal contents and mostly the intestinal contents are dragged from the bird and kept nearby carcasses are in the same shop that results higher counts of Feecal coliform counts (Ahmad *et al.*, 2013) [3].

Yeast and mould count

The mean Yeast and Mould count in the chicken samples from Road side slaughtering stalls was $4.38 \times 10^5 \pm 0.50 \times 10^5$ CFU/gm ranging from 8.6×10^4 - 1.3×10^6 CFU/gm, which was very high compared to the counts from Large scale processing centers ($1.36 \times 10^3 \pm 0.38 \times 10^3$ CFU/gm) ranging from 0.8×10^3 - 8.3×10^3 CFU/gm and hygienically maintained chicken shops ($3.86 \times 10^4 \pm 0.45 \times 10^4$ CFU/gm) ranging from 9.1×10^3 - 8.6×10^4 CFU/gm.

The Yeast and mould count in the chicken from Large scale processing centers was 1.36×10^3 CFU/gm, which was similar to the count of 1.7×10^3 CFU/gm reported by Dhanze *et al.* (2012) [16]. Yeast and mould Counts of 7.4×10^1 , 9.7×10^2 and 9×10^2 CFU/gm which were lower than the counts of Large scale processing centers in the present study (1.36×10^3 CFU/gm) was reported by Kumar *et al.* (2012), Capita *et al.* (2001) and Vilojen *et al.* (1998) respectively.

The Yeast and mould count in the chicken from Hygienically maintained chicken shops in the present study was 3.86×10^4 CFU/gm, which was similar to the counts of 6.0×10^4 and 1.2 - 1.3×10^4 CFU/gm reported by Omorodin and Odu (2014) [31] and Sakia and Joshi (2010) [33-24] respectively. Yeast and mould Counts of 1.8×10^2 CFU/gm, which was lower than the counts of Hygienically maintained chicken shops in the present study was reported by Kumar *et al.* (2012).

The Yeast and mould count in the chicken from Road side slaughtering stalls was 4.38×10^5 CFU/gm, which was similar to the counts of 5.0×10^5 and 1.0 - 1.3×10^5 CFU/gm reported by Afolabi *et al.* (2017) [2] and Sakia and Joshi (2010) [33-24] local meat markets of North east India respectively. Yeast and mould Counts of 7.2×10^6 , 1.2×10^7 and 2.7×10^7 CFU/gm which were higher than the counts of Road side slaughtering stalls in the present study was reported by Barbudhe *et al.* (2003), Mukopadhyay *et al.* (2004) and Erdem *et al.* (2011) respectively. Yeast and mould Counts of 3.3×10^2 CFU/gm which was lower than the counts of Road side slaughtering stalls reported by Kumar *et al.* (2012).

Conclusions

In general the microbial load is higher in the chicken collected from Road side vendors, due to existence of very unhygienic premises, hand less and direct exposure to the contaminated air (Cohen *et al.*, 2007) [13]. The quality of chicken was better from Large scale processing centers due to implementation of partly or wholly HACCP program and general hygienic principles. (Yashodha *et al.*, 2001), where as the chicken from Hygienically maintained shops was in between the two sources as they maintained minimum clean and hygienic conditions to have customer satisfaction (Obeng *et al.*, 2013) [30].

Under Indian conditions only less than 10% of the chicken meat is processed under organized sector and majority of the chicken meat is processed either in small chicken centers or Road side slaughtering stalls. The microbiological quality of

chicken meat processed under prevailing conditions is not confirming to the standards and leading to public health problems.

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