Original Research

Studies on the Physical and Microbiological Quality of Different Meats Sold in and Around Greater Hyderabad Municipal Corporation (GHMC)

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Abstract

A study was conducted to know the physical and microbiological quality of various meats sold in and around Greater Hyderabad Municipal Corporation (GHMC). Majority samples of chevon, mutton, chicken, & pork were of good quality by boiling test, good and moderate by Nitrazine yellow test, whereas imperfect bleeding by Malachite green test was moderate to good and some samples were bad. The incidence of E. coli, Salmonella spp and Staphylococcus spp was 73.3%, 56.7% and 100% respectively in chevon, 60%, 43.3% and 86.7% respectively in mutton, 90%, 100% and 90% respectively in chicken and 86.7%, 73.3% and 100% respectively in pork. The total viable count, coliforms, faecal coliforms and yeasts& molds counts were 6.51log$_{10}$, 3.81 log$_{10}$, 2.68 log$_{10}$ and 58 CFU/g respectively in chevon. 2.55 log$_{10}$, 3.82 log$_{10}$, 5.71 log$_{10}$ and 34 CFU/g respectively in mutton. 4.85 log$_{10}$, 6.58 log$_{10}$, 2.1 log$_{10}$ and 42 CFU/g respectively in chicken. 4.15 log$_{10}$, 3.68 log$_{10}$, 4.2 log$_{10}$& 62 CFU/g respectively in pork.

Key words: Chevon, Chicken, Pork, Coliforms, Faecal Coliforms Counts, Mutton, Total Viable Count (TVC), Yeast and Molds

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Introduction

Meat is an important edible postmortem component originating from food animals. The increasing demand for animal proteins like meat and meat products has increased load of slaughter houses, resulting in inadequate attention being paid to the hygienic aspect of meat production. During the process of converting live food animal into meat, microbial contamination of carcass is unavoidable. During the process of dehiding, evisceration, cutting, packing, etc., meat is exposed to various environmental contaminants which may be from diseased animal, unhygienic environment, unhygienic butchering habits, faulty slaughter

procedures, post slaughter handling and storage (Mawia *et al*., 2012). In India, temperature and humidity are ideal for growth and survival of microorganisms. Hot climate and lack of proper storage facilities, render meat, vulnerable to spoilage, thus, posing risk to consumers (Chaubey *et al*., 2004). Cross contamination occurs during handling of raw meat especially poultry meat, due to presence of more liquid in raw meat.

Contamination of meat with food borne pathogens remains an important public health issue, as it can lead to illness resulting human suffering and loss of productivity and significantly to the cost of health care. Raw meat may harbor many important pathogenic microbes such as *E. coli*, *S. aureus*, *Campylobacter*, *Salmonella*, *Listeria* etc., that causes risk to the human health (Mead *et al*., 1999). Poultry meat is more popular in India due to cheaper cost, accepted by many classes, easily available and good digestibility (Yashoda *et al*., 2001). If microbial contamination exceeds certain levels, it adversity affects Shelf life and renders the meat unfit for human consumption (Fasanmi *et al*., 2010). As per guidelines stipulated to ensure safe meat handling by World Health Organisation (WHO), Food and Agriculture Organisation (FAO) and Codex Alimentarius Commission, Hazard Analysis Critical Control Point (HACCP) and Good Manufacturing Practices (GMP) plays important role (Hassan Ali *et al*., 2010).

In India the retail sale of meat is not organised and the conditions in meat shops is not up to the satisfactory level which may lead to enhancement of microbial contamination. Much work has not been conducted about the microbial quality of various varieties of meat in and around Greater Hyderabad Municipal Corporation (GHMC), hence this study was undertaken.

Materials and Methods

30 each of mutton, chevon, chicken and pork samples (50gms) were collected from meat retail shops from different geographical areas in and around Greater Hyderabad Municipal Corporation (GHMC), packed in self sealed sterile polyethylene bags, kept in thermocool box with ice and transported to the laboratory of Veterinary Public Health, College of Veterinary Science, Rajendranagar, Hyderabad and stored at -20 °C till further examination.

Boiling Test

Small piece of meat sample was added into a test tube to which 10 ml of water was added, closed tightly with cotton plug and boiled. The cotton plug was taken out and the steam vapour was smelled to evaluate possible abnormal orders in carcasses.

Malachite Green Test

6 grams of meat sample was taken in a conical flask then 14 ml of distilled water was added to it and was allowed to stand for 15 minutes. The sediment formed was removed and 0.7ml of extract was taken into test tube containing a drop of malachite green and a drop of hydrogen peroxide and then shaken the mixture

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until it foams. It was allowed to stand for 20 minutes, clear and blue color liquid indicates good quality, cloudy and green color liquid indicates moderate quality, cloudy and olive green color liquid indicates bad quality meat.

Nitrazine Yellow Test

Small quantity of sample was taken in petri dish, Nitrazine yellow indicator was added to it then colour change was observed. Yellow colour indicates good quality (Ph-6.0), Olive green indicates moderate quality (Ph-6.4) and bluish violet indicates bad quality (Ph-6.8).

Microbiological Analysis

10 grams of meat sample was added in 90 ml sterile distilled water or 0.1% peptone water and was homogenized in a stomacher, which gives 1:10 dilution.1 ml from first dilution (10^1) was transferred to second test tube and so on containing 9ml to give 1:100, 1:1000, 1:10000, 1:100000 dilution.1 ml from appropriate dilution was transferred into sterile petri dish and10-15ml of nutrient agar was added for Total viable count (TVC) , Mac conkey for coliforms and faecal coliforms, Sabouraud Dextrose Agar (SDA) for yeast and molds. The plates were inverted and incubated at 37°C for TVC, coliforms and 44.5°c for faecal coliforms. The incubation period is 24 to 28 hours for all except 4-5 days for yeast and molds.

Isolation and Enumeration of Pathogenic Microorganism

For isolation of *Escherichia coli*, Salmonella *spp* and *staphylococcus aureus* EMB agar, XLD agar and MSA agar were used respectively, and counts were made on these media using appropriate dilution of the samples.

Results and Discussion

Physiochemical Evaluation

Boiling test, Nitrazine yellow test and Malachite green test results were presented in Table 1. Based on boiling test chevon (100%), mutton (66.7%), chicken (83.3%) and pork (53.3%) samples were of good quality. This test is an index for abnormal odours. Chevon (50%), mutton (66.7%) and chicken (50%) were good based on Nitrazine yellow test, whereas all the samples of pork, 50% of chevon and chicken and 33.3% of mutton were of moderate quality. None of the samples are bad. This test indicates the developed alkalinity due to decomposition of meat. Based on Malachite green test 50% of chevon were moderate quality, where as 26.7% and 23.3% were good and bad quality respectively. 33.3 % of each mutton samples were good, moderate and bad quality respectively, whereas 76.7% of chicken and 73.3% of pork were good quality and remaining are moderate quality. None of the chicken and pork samples are bad.

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Table 1: Quality of meat samples

S. No	Type of Meat	Boiling Test		Nitrazine Yellow Test			Malachite Green		
		Good quality	Bad quality	Good	Moderate	Bad	Good	Moderate	Bad
1	**Chevon 30**	30 (100%)	0 (0%)	15 (50%)	15 (50%)	0 (0%)	8 (26.70%)	15 (50%)	7 (23.30%)
2	**Mutton 30**	20 (66.70%)	10 (33.30%)	20 (66.70%)	10 (33.30%)	0 (0%)	10 (33.40%)	10 (33.30%)	10 (33.30%)
3	**Chicken 30**	25 (83.30%)	5 (16.70%)	15 (50%)	15 (50%)	0 (0%)	23 (76.70%)	7 (23.30%)	0 (0%)
4	**Pork 30**	16 (53.30%)	14 (46.70%)	0 (0%)	30 (100%)	0 (0%)	22 (73.30%)	8 (26.70%)	0 (0%)

Total samples = 30

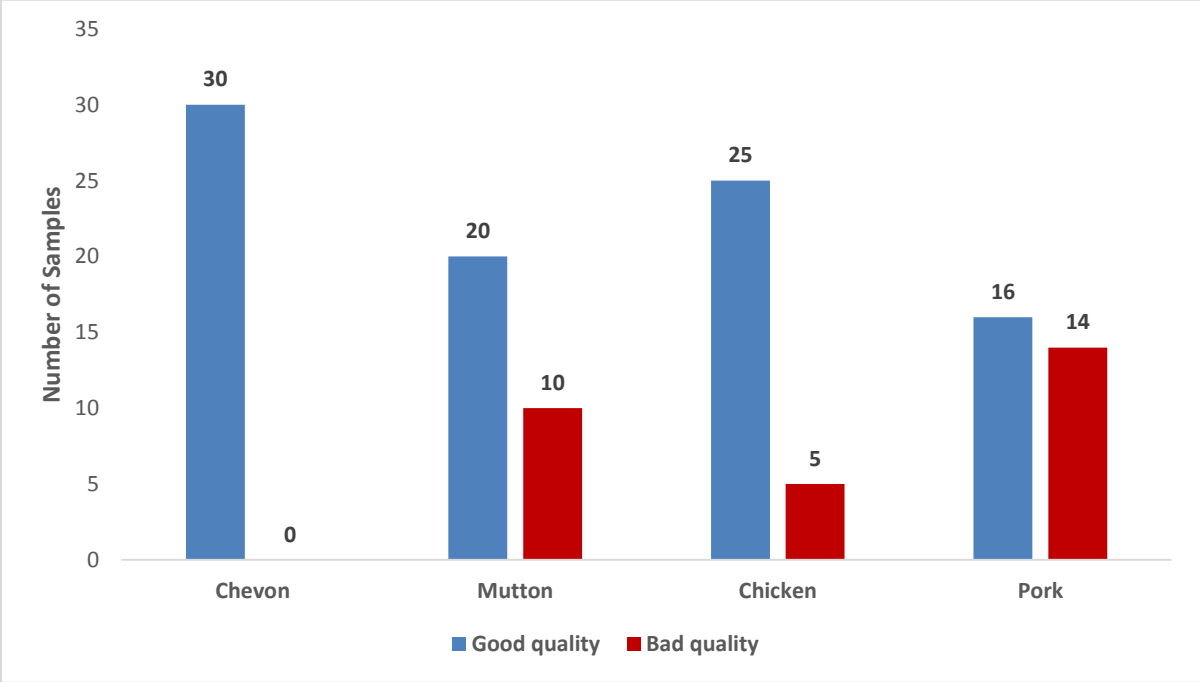

Fig. 1: Boiling Test

Microbiological Quality

Total viable count, coliforms, faecal coliforms, yeast and mold counts of the meat samples are presented in Table 2.

Table 2: Microbial counts in various meat samples (CFU per gram)

S. No.	Types of Meat	TVC	Coliforms	Faecal Coliforms	Yeast and Molds
1	Chevon	6.51 $\log_{10}$	3.81 $\log_{10}$	2.68 $\log_{10}$	58
2	Mutton	2.55 $\log_{10}$	3.82 $\log_{10}$	5.71 $\log_{10}$	34
3	Chicken	4.85 $\log_{10}$	6.58 $\log_{10}$	2.1 $\log_{10}$	42
4	Pork	4.15 $\log_{10}$	3.68 $\log_{10}$	4.2 $\log_{10}$	62

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The total viable count in Chevon samples was 6.51 log_{10}CFU/gm in the present study, which was less than the counts of 6.62 log_{10}CFU/cm^2reported by Ahmad *et al.* (2013), higher than the counts of 6.37 reported by Mawia *et al.* (2012) and in the range of the counts of 4.09 to 6.79 log_{10} CFU/cm^2reported by Feizullah and Daskalov (2010). The total viable count in mutton samples was 2.55 log_{10}CFU/gm in the present study, which was less than the counts of 6.92 log_{10} CFU /cm^2 and 4.32 to 7.2 log_{10} CFU/gm reported by Ahmad *et al.* (2013) and Feizullah and Daskalov (2010) respectively and higher than the counts of 2.4 log_{10} CFU/cm^2 reported by Bass *et al.* (2011). The total viable count in chicken samples was 4.85 log_{10}CFU/gm in the present study, which was less than the counts of 7.22 log_{10}CFU/$cm^2$and 6.82 log_{10} reported by Ahmad *et al.* (2013) and Singh *et al.* (2014). The total viable count in pork samples was 4.15log_{10}CFU/gm in the present study, which was less than the counts of 7.78 log_{10} CFU/g reported by Lambey *et al.* (2009). The coliforms count in mutton samples was 3.82 log_{10}CFU/gm in the present study, which was higher than the counts of 2.78 log_{10}CFU/cm^2 reported by Ahmad *et al.* (2013).

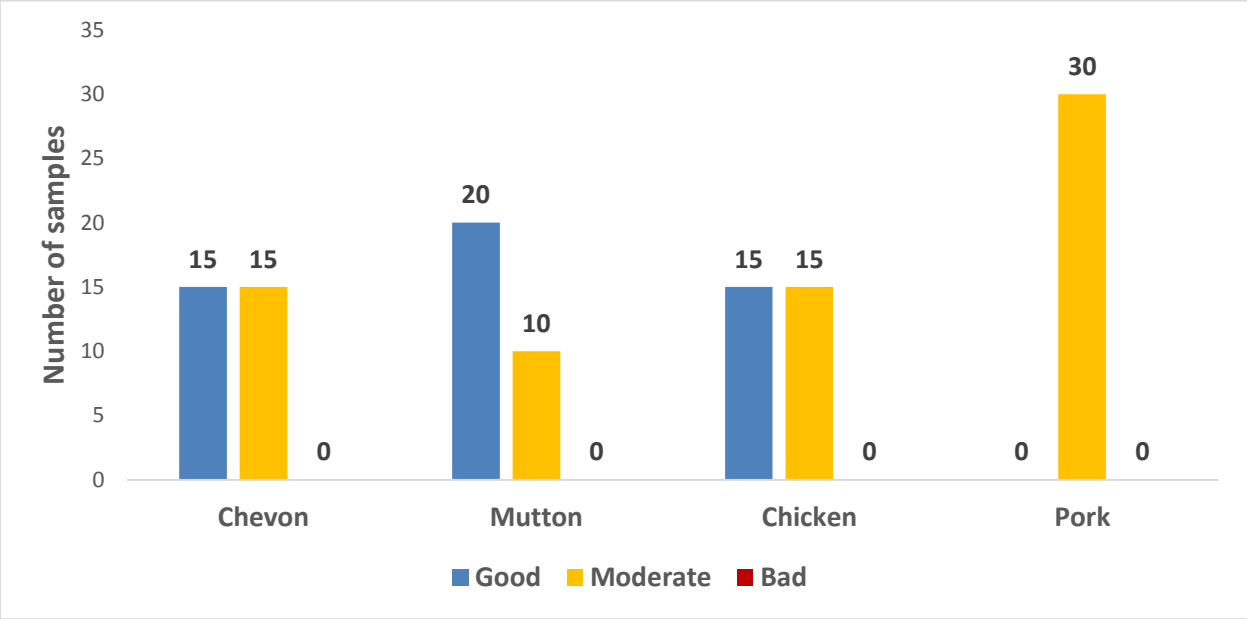

Fig. 2: Nitrazine Yellow Test

In Chevon sample the coliforms count was 3.81 log_{10}CFU/gm in the present study, which was higher than the counts of 2.74log_{10}CFU/cm^2 reported by Ahmad *et al.* (2013). In chicken sample the coliforms count was 6.58 log_{10}CFU/gm in the present study, which was higher than the counts of 1.94 log_{10}CFU/cm^2reported by Ahmad *et al.* (2013).The coliforms count in pork was 3.68 log_{10} CFU/gm in the present study which was lower than the counts of 4.29 log_{10} CFU/gm reported by Lambey *et al.* (2009).

The incidence of certain pathogenic microorganisms in different meat samples was presented in Table 3. The incidence of *E. coli* in mutton samples was 60% in the present study, which was higher than the

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incidence (55%) and (49%) reported by Ahmad *et al.* (2013) and Yadav *et al.* (2006) respectively and less than the incidence (96%) reported by Sharma *et al.* (2015). The incidence of *E. coli* in chevon sample was 73.3% in the present study, which was higher than the incidence (50%) reported by Ahmad *et al.* (2013) and less than the incidence (83.3%) reported by Rathod *et al.* (2004) .The incidence of *E. coli* in chicken sample was 90% in the present study, which was higher than the incidence (48%)and (39.5%)reported by Ahmad *et al.* (2013) and Vorster *et al.* (1994)respectively and less than the incidence (100%) reported by Sharma *et al.* (2015).The incidence of *E. coli* in the pork sample was 86.7% in the present study.

Table 3: Incidence of certain pathogenic microorganisms in various meat samples

S. No.	Types of Meat	*E. coli*	*Salmonella spp*	*Staphylococcus spp*
1	Chevon	22 (73.3%)	17 (56.70%)	30 (100%)
2	Mutton	18 (60 %)	13 (43.30 %)	26 (86.70 %)
3	Chicken	27 (90 %)	30 (100 %)	27 (90 %)
4	Pork	26 (86.70 %)	22 (73.3%)	30 (100%)

Total samples = 30

Fig. 3: Malachite Green Test

The incidence of *Salmonella spp* in Mutton sample was 43.3% in the present study, which was higher than the incidence of 2%, 3% and 10% reported by Sharma *et al.* (2015), Yadav *et al.* (2006) and Ahmad *et al.* (2013) respectively. The incidence of *Salmonella spp* in Chevon sample was 56.7% in the present study, which was higher than the incidence (10%) reported by Ahmad *et al.* (2013). The incidence of *Salmonella spp* in chicken sample was 100% in the present study, which was higher than the incidence 2% and 25%

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reported by Sharma *et al.* (2015) and Ahmad *et al.* (2013) respectively. The incidence of *Salmonella spp* in pork sample was 73.3% in the present study.

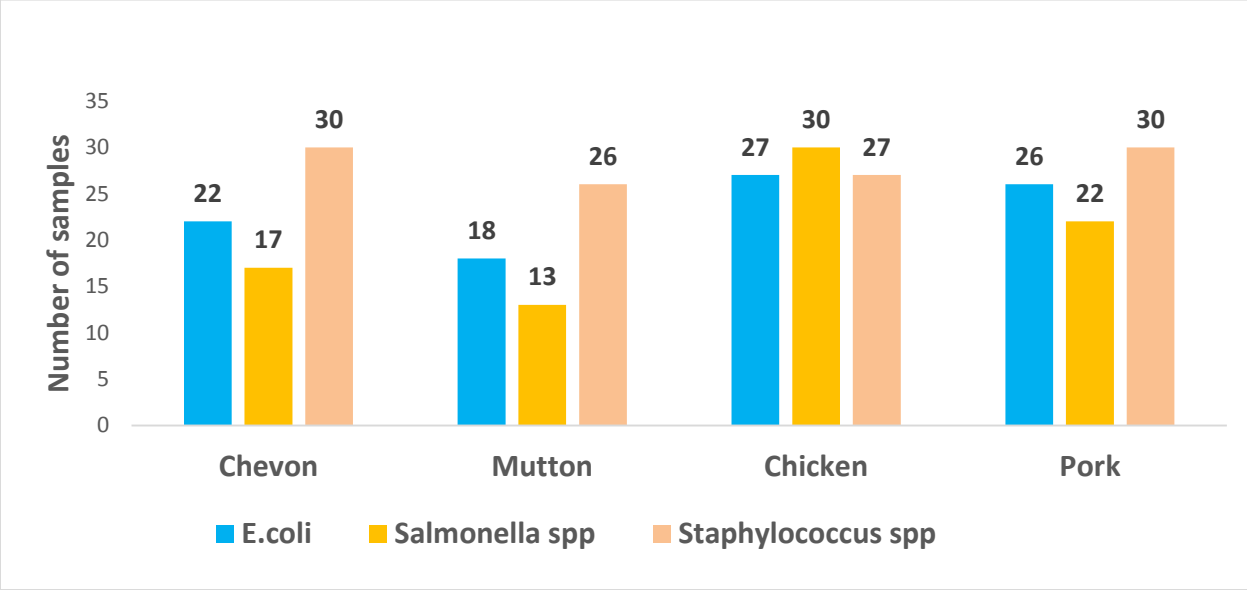

Fig. 4: Incidence of pathogenic microbes in samples

The incidence of *Staphylococcus spp* in mutton samples was 86.7% in the present study, which was higher than the incidence of 18%, 68.6% and 45% reported by Sharma *et al.* (2015), Kumar *et al.* (2001) and Ahmad *et al.* (2013) respectively. The incidence of *Staphylococcus spp* in Chevon sample was 100% in the present study, which was higher than the incidence (70%) reported by Ahmad *et al.* (2013) and similar to 100% reported by Rathod *et al.* (2004) .The incidence of *Staphylococcus spp* in chicken sample was 90% in the present study, which was higher than the incidence of 22%, 23.4% & 55% reported by Sharma *et. al.* (2015), Vorster *et al.* (1994) and Ahmad *et al.* (2013) respectively. The incidence of *Staphylococcus spp* in pork samples was 100% in the present study.

Conclusion

On the basis of physical quality test (boiling test, nitrazine yellow & malachite green test) chevon and chicken were of good quality whereas, mutton & pork moderate to good quality. The microbiological quality of different meats based on total viable count (TVC), coliforms, faecal coliforms and yeast & mold counts were far above the standards specified under FSSAI 2011. Presently, the quality of meat sold in various markets were of inferior quality. Necessary steps should be taken to improve the quality by maintaining hygienic measures at all stages.

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