MALAY DAS, DEVAJANI DEKA, SUBHASH TARAPHDER¹, SUMITRA PANIGRAHI² and SATYAKI CHAKRABORTY³*

Department of Veterinary Public Health & Epidemiology, ³Department of Veterinary Microbiology, College of Veterinary Sciences and Animal Husbandry, CAU, Aizawl-796014, India ¹Department of Animal genetics and Breeding, WBUAFS, Kolkata ²Department of Veterinary Public Health & Epidemiology, LUVAS, Hisar-125004, India

Received: 21.08.2018; Accepted: 22.01.2019

SUMMARY

The present study was aimed to determine the bacteriological quality of raw meats from the unorganized butcher shops in the retail markets of Aizawl, Mizoram. A total of 100 raw meat samples (beef=25, chevon=25, chicken=25 and pork=25) were processed for Total Viable Count (TVC) and Coliform Count (CC). Mean value of TVC (\log_{10} cfu/g) of raw beef, chevon, chicken and pork was found to be 6.2433±0.0300, 5.6919±0.0898, 5.9292±0.0565 and 5.9607±0.0442, respectively, which varied significantly (p<0.01) between the species. The overall mean values of CC (\log_{10} cfu/g) were 5.8784±0.0721, 4.5883±0.3291, 5.1342±0.1811, and 5.3230±0.1348 for beef, chevon, chicken and pork, respectively. There was highly significant difference in CC values between different meats (p<0.01). Both TVC and CC values were highest in beef and lowest in chevon. Although the mean TVC was less than the acceptable limit of food safety in all types of meat, the CC values were much higher than the permissible limits for consumption. Strategic actions are needed for hygienic production of raw meats.

Keywords: Bacteriological quality, Coliform count, Raw meats, Total viable count

Meat and meat products have increasingly become part of daily human diet because of its rich nutritive composition (Chuku et al., 2016). As meat is highly nutritious in nature, it provides a suitable environment for the growth of pathogenic as well as spoilage microorganisms (Steinkraus, 1994). Different meat borne diseases are one of the main health issues throughout the world. Contaminated raw meat acts as an important source of food-borne illness (Podpecan et al., 2007). Meat is frequently contaminated with high level of Klebsiella pneumoniae, Enterobacter spp., Pseudomonas aeruginosa, Escherichia coli, Salmonella spp., Serratia marcescens, Proteus vulgaris, Staphylococcus aureus and Bacillus spp. (Ateba and Setona, 2011). Visually, the microbial contamination in raw meat and meat products cannot be detected (Movassagh et al., 2010). Maximum fresh meats are sold in the unorganized retailed open-air shops and in the road side by keeping for longer duration without maintaining the chilling temperature which increases the chances of low bacteriological quality of meat causing meat borne diseases among the consumers (Muhammad et al., 2011). Mizoram, being a very small land lock hilly state of Northeastern India, animal husbandry is very popular and meat consumption is very common. The present study was aimed to assess the bacteriological quality of raw meat (beef, chevon, chicken and pork) sold in unorganized butcher shops by determining Total Viable Count (TVC) and Coliform Count (CC).

A total of 100 raw meat samples (100 gram each)

were collected aseptically from unorganized local markets of Aizawl during the period of March, 2016 to October, 2016 and were processed immediately upon arrival in the Food Safety laboratory of Department of Veterinary Public Health and Epidemiology, CVSc & AH, CAU, Selesih, Aizawl for bacteriological quality. Proper cold chain was maintained during transportation. The TVC and CC were determined according to the procedure recommended by Ouinn et al. (1994). Ten grams of raw meat sample was weighed and placed into 90 ml one percent peptone water and placed in a stomacher for two minutes. Subsequently 10-fold serial dilutions of meat samples were made up to 10^{-6} and 0.1ml from appropriate dilution was transferred to sterilized Nutrient agar and MacConkeyagar plates for TVC and CC, respectively and incubated at 37 °C for 24-48 hours. Agar plates exhibiting 30 to 300 bacterial colonies were counted. Pink colonies in the MacConkey agar were considered for the coliform count as they are lactose fermenter and could be separated from non-lactose fermenting other Enterobacteriacae bacteria. The average number of colonies in a particular dilution was multiplied by the dilution factor to obtain the TVC and CC and the results were expressed as mean log colony forming unit (cfu) per gram. Statistical analysis was done by one way ANOVA (Snedecor and Cochran, 1994).

All the enumerated values of TVC and CC in raw beef, chevon, chicken and pork are expressed in terms of \log_{10} .

The overall mean TVC values of raw beef, chevon, chicken and pork were 6.2433 ± 0.0300 , 5.6919 ± 0.0898 ,

^{*}Corresponding author: satyaki2692.sc@gmail.com

Mean TVC of different types of raw meats from Aizawl in different dilutions											
Dilution	Beef (n=25)	Chevon (n=25)	Chicken (n=25)	Pork (n=25)	Combined (n=100)	f-value					
			TVC								
10-3	5.4467±0.0169°	5.1647±0.0553 ^a	$5.2938{\pm}0.0396^{\circ}$	5.3503 ± 0.0343^{bc}	5.3139±0.0218	9.122**					
10-4	$6.2495{\pm}0.0318^{\text{b}}$	5.913±0.0681ª	5.9461±0.0525ª	$6.0545{\pm}0.0452^{a}$	$6.0408 {\pm} 0.0284$	8.818**					
10-5	7.0336±0.0489°	5.9979±0.1875 ^a	$6.5477{\pm}0.0908^{\text{b}}$	$6.4773{\pm}0.0719^{\text{b}}$	6.5141±0.0667	14.102**					
Overall	$6.2433{\pm}0.0300^{a}$	5.6919 ± 0.0898^{b}	$5.9292{\pm}0.0565^{\circ}$	5.9607 ± 0.0442^{b}	$5.9563 {\pm} 0.0352$	14.461**					

Table 1 Mean TVC of different types of raw meats from Aizawl in different dilution

NS- Non-significant at P<0.05; *Significant at P<0.05; **Significant at P<0.01

Mean CC of different types of raw meats from Aizawl in different dilutions											
Dilution	Beef (n=25)	Chevon (n=25)	Chicken (n=25)	Pork (n=25)	Combined (n=100)	f-value					
			CC								
10-3	5.0673±0.0546 ^b	4.3682±0.2681ª	4.8254±0.0740 ^b	4.9002±0.0802 ^b	4.9703±0.0770	4.119**					
10-4	5.8841±0.0751 ^b	4.9153±0.3039ª	$5.3921 {\pm} 0.0996^{ab}$	5.4885±0.1005 ^b	5.4200 ± 0.0914	5.374**					
10-5	6.6839±0.0958°	4.4815±0.5299 ^a	5.1853±0.3967 ^{ab}	5.5805±0.2597 ^b	5.4828 ± 0.1940	6.586**					
Overall	5.8784±0.0721 ^b	4.5883±0.3291ª	5.1342±0.1811 ^b	5.3230±0.1348 ^b	5.2310±0.1101	6.890**					

Table 2

NS- Non-significant at P<0.05; *Significant at P<0.05; **Significant at P<0.01

 5.9292 ± 0.0565 and 5.9607 ± 0.0442 \log_{10} cfu/g, respectively (Table 1). Highly significant difference between four raw meats (beef, chevon, chicken and pork) was observed in relation to TVC (p<0.01). The TVC was found to be highest in beef and lowest in chevon.

Singh *et al.* (2014) observed the mean values of standard plate count (SPC) $(\log_{10}cfu/g)$ to be 7.03±0.07, 6.96±0.78, 6.86±0.02 and 6.75±0.04 for cara beef, chevon, prok and poultry meat, respectively in Agra region, India which were much higher than the present findings. In another study by Lambey *et al.* (2009), SPC was determined as 7.78 cfu/g and 7.03 cfu/g for chevon and pork in Mathura, India which were also higher than the present findings. However, the present TVC of pork was higher to the findings record by Inthvang *et al.* (2006) who reported aerobic plate count (APC) of fresh pork to vary between 4.4-5.3 (log₁₀ cfu/g). Mukhopadhyay *et al.* (2009) also recorded the APC in chevon ranging between 5.931 to 10.94 (log₁₀ cfu/g).

The mean CC (\log_{10} cfu/g) was 5.8784±0.0721 for beef, 4.5883±0.3291for chevon, 5.1342±0.1811for chicken and 5.3230±0.1348 for pork (Table 2). There was highly significant difference (P<0.01) between the four different types of raw meat (beef, chevon, chicken and pork) in relation to CC. The CC was found highest in beef and lowest in chevon.

Mean values of CC (log₁₀cfu/g) were found to be

 3.04 ± 0.08 for cara beef, 3.93 ± 0.14 for chevon, 3.40 ± 0.10 for pork and 3.82 ± 0.12 for poultry, in Agra region as reported by Singh *et al.* (2014). The high CC in different kinds of meat in the present study indicated the poor hygiene and sanitation in raw meat production and sale under the unorganized slaughtering and marketing in the Aizwal city. Chuku *et al.* (2016) reported that samples from three different markets of Nigeria, namely Shinge, Hawkers and Lafia old market, had higher mean CC than the present study; i.e. 6.1×108 cfu/g, 1.82×108 cfu/g and 1.11×108 cfu/g, respectively. Lambey *et al.* (2009) observed the mean CC for chevon and pork were 4.29 and 4.15 (\log_{10}), respectively in Mathura city, which were lower than the present findings.

The present study indicated that the TVC or presence of total microorganisms in raw meat was within the maximum permissible limit whereas the CC was beyond the safe limit. The high CC may be due to use of contaminated water in meat production practices besides improper sanitation and thus there is a need for identification of the critical points of contamination. At the same time, the personal hygiene of the butchers is maintained.

REFERENCES

- Ateba, C.N. and Setona, T. (2011). Isolation of enteric bacterial pathogens from raw mince meat in Mafikeng, North-West Province, South Africa. *Life Sci. J.* **8**: S2.
- Chuku, A., Etim, L.B., Obandel, G.A., Asikong, B.E. and Sani, B.E.

(2016). Bacteriological quality of fresh raw beef and chevonretailed in Lafia Metropolis, Nigeria. *J. Microbiol. Res.* **6(2)**: 29-34.

- Inthavong, P., Srikitjakarn, L., Kyule, M., Zessin, K.H., Baumann, M., Douangngeun, B. and Fries, R. (2006). Microbial contamination of pig carcasses at a slaughterhouse in vientiane capital, LAO PDR. *SE Asian J. Trop. Med. Pub. Health.* **37(6)**: 1237-1241.
- Lambey, H.S., Verma, A.K., Jain, U., Mahima and Bist, B. (2009). Bacteriological quality of chevon and pork in Mathura city U.P (India). J. Vet. Pub. Hlth. 7(2): 141-143.
- Movassagh, M.H., Shakoori, M. and Zolfaghari, J. (2010). The prevalence of *Salmonella* spp. In: Bovine carcass at Tabriz slaughterhouse, Iran. *Glob. Vet.* **5(2)**: 146-149.
- Muhammed M.S., Fazlina, F., Jasbir, S., Arshad, M.M, Khan, M. and AL-Sultan, A.I. (2011). Isolation of bacteria from bovine meat obtained from backyard slaughter in Kelantan. *J. Adv. Med. Res.* 1:61-64.

- Mukhopadhyay H.K., Pillai R.M., Pal U.K. and Ajay V.J. (2009). Microbial quality of fresh chevon and beef in retail outlets of Pondicherry. Tamilnadu. J. Vet. Anim. Sci. 5(1): 33-36.
- Podpecan, B., Pengov, A. and Vadnjal, S. (2007). The source of contamination of ground meat for production of meat products with bacteria *Staphylococcus aureus*. *Slov. Vet. Res.* 44: 24-30.
- Quinn, P.J., Carter, M.E., Markey, B.K. and Carter, G.R. (1994). In: Clinical Veterinary Microbiology. London, UK: Wolf Publishing, pp. 21-66.
- Singh, V.K., Jain, U., Yadav, J.K. and Bist, B. (2014). Assessment of bacterial quality of raw meat samples (carabeef, chevon, pork and poultry) from retail meat outlets and local slaughter houses of Agra region, India. J. Foodborne Zoo. Dis. 2(1): 15-18.
- Snedecor, G.W. and Cochran, W.G. (1994). Statistical methods (8th Edn.), Lowa State University Press, USA.
- Steinkraus, K.H. (1994). Nutritional significance of fermented foods. *Food Res. Int.* **27**:259-267.