Quality and Safety of Meat and Meat Products Available in Mymensingh, Bangladesh

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Abstract

This study was conducted to know the quality and safety of meat and meat products available in Mymensingh Sadar on the basis of microbiological assessment. Twelve meat samples from four retail meat markets and six meat products samples from different shops of Mymensingh Sadar were collected. These samples were subjected to determine total viable count (TVC), total coliform count (TCC) and total staphylococcal count (TSC). Assessments on hygienic practices were performed by using a standard questionnaire. TVC, TCC and TSC in meat samples of selected Shesmore, Kewatkhal, Mesoobazar and Chotobazar markets were determined. In raw meat mean value of TVC, TCC and TSC for Shesmore, Kewatkhal, Mesoobazar and Chotobazar were 7.34, 6.99, 8.46, 8.43 log CFU/g; 3.37, 0.0, 3.36, 0.0 log CFU/g and 5.4, 5.44, 4.74, 6.19 log CFU/g respectively. In meat products like Chicken Toast, Burger and Hotdog, mean value of TVC for K.R market and Mymensingh city market were 7.43, 7.45, 6.99 log CFU/g and 7.09, 7.08, 6.47 log CFU/g; mean value of TCC for K.R market and Mymensingh city market were 0.00, 0.00, 3.93 log CFU/g and 0.00, 0.00, 3.33 log CFU/g; mean value of TSC for K.R market and Mymensingh city market were 5.44, 5.45, 5.41 log CFU/g and 5.22, 5.28, 4.93 log CFU/g respectively. The variation of TVC and TSC of different markets were significant (P<0.01) whereas TCC was not significant at this level. In meat products TSC of chicken toast and burger was significant (P<0.05) at 5% level of probability and TCC in chicken toast and burger was not significant at this level, rest of them were significant (P<0.01) at 1% level of probability. Only 5.71% people have the knowledge on hygienic meat production. About 54.29% people don’t follow pre-slaughter inspection. Suggestion has been given to improve the knowledge on hygiene among the meat producers to reduce microbial count.

Keywords: Meat, Meat products, Microbial count, Quality, Safety.

1. Introduction

Meat is a primary dietary component and forms an important part of a balanced and varied diet (Rolfes et al., 2008). Recently, food safety has become an extremely important and ensuring products safety is an international public health concern as well as in Bangladesh. Meat and meat products are important sources of zoonotic infections. Several pathogens in meats, e.g., Staphylococcus spp., Campylobacter spp. and Verocytotoxin producing Escherichia coli (VTEC), are most efficiently controlled by interventions applied in the primary production in combination with optimization of the slaughter hygiene (Nørrung et al., 2008). Implementation of good hygiene practice and procedures based on hazard analysis and critical control point (HACCP) principles at slaughterhouses are essential to minimize carcass contamination. In Bangladesh total meat production per year is about 6.44 million metric tons where the beef contributes around 2.47 million (38.35%) tons (FAO, 2013). Microorganisms present in meat may be harmful for human. If kept at unfavorable temperature, meat undergoes spoilage. Indicator organisms in meat may be employed to determine the sanitary quality. Many researchers have isolated and identified heterogeneous types of micro flora from fresh meat. Members of the genus Salmonella, Yersinia enterocolitica, Clostridium perfringens and Campylobacter jejuni cause food poisoning. Clostridium botulinum, Staphylococcus aureus, Bacillus cereus etc. cause meat borne intoxication chiefly. Spoilage of raw meat in air is caused chiefly by the growth and metabolic activity of
aerobic organisms like Pseudomonas, Bacillus, Staphylococcus, Micrococcus etc. Meat has been considered as an important vehicle for the transmission of food pathogens of gastrointestinal origin. Several meat borne epidemics have been reported throughout the recent years (Brahmbhatt et al., 1991). Food-borne diseases, caused by agents that enter the body through the intake of contaminated food materials are one of the primary public health concerns (Tan et al., 2013). It affects the people’s well-being, and imposes economic impacts (Akbar et al., 2013). In many developing countries, food-borne diseases outbreak from bacteria, such as Escherichia coli and Salmonella spp. impose a substantial burden on health care systems and can markedly reduce the economic productivity of the countries. In recent years, food borne infections and intoxications have assumed significance as a health hazard. Epidemiological reports suggest that poultry meat is still the primary cause of human food poisoning (Mulder, 1999). Poultry meat is more popular in the consumer market because of advantages such as easy digestibility and acceptability by the majority of people (Yashoda et al., 2001). However, the presence of pathogenic and spoilage microorganisms in poultry meat and its byproducts remains a significant concern for suppliers, consumers and public health officials worldwide. Bacterial contamination of these foods depends on the bacterial level of the poultry carcasses used as the raw product, the hygienic practices during manipulation and on the time and temperature of storage (El-Leithy et al., 1989). However, the control and inspection during production, storage and distribution are generally rare. Therefore, it is important to prevent the hazards and to provide a safe and wholesome product for human consumption (Singh et al., 1984). Normally meat is consumed by the people of the country following traditional cooking method. Sometimes beef is dried and salt cured during the surplus production by conventional method. Effect of urbanization is reducing the cooking time of the people. Meat products are ready-to-cook and have extended shelf life. Moreover, it reduces the time for processing and cooking. Some of them can be consumed without cooking. Therefore, there is a great opportunity for producing meat products for the urban people. Modern-day consumers are concerned of the quality and safety of processed meat products. This study will be carried out to assess the quality and safety of meat and meat products in the Mymensingh district. The experiment was accomplished with the objectives to evaluate microbial quality of meat and meat products sold in some selected markets in the Mymensingh, to know how animals are handled prior to slaughter and how is handled after slaughter and to identify the possible sources of contamination and their remedies.

2. Material and Methods

2.1 Source of Sample

All samples were obtained from local retail markets such as K.R market at BAU campus, Sheshmore market, Kewatkhali market, Mesoa Bazar, Choto Bazar and Mymensingh city market. The markets are run by the local municipal authorities and Upazila Parishad. Cattle of different ages are brought to convenient slaughter points and killed by Halal method. After flaying the whole sell cut were prepared. Then from thigh region muscle sample were taken into a sterilized bag. In case of meat product samples were collected as they were served to the clients.

2.2 Collection and Transportation of Samples

Samples were collected aseptically in sterile bag and brought to the Bacteriology laboratory of the Department of Microbiology and Hygiene, BAU within 1 hour to determine the total viable bacterial count (TVC) and occurrences of different micro flora gaining access to meat. During transportation the sterile containers were kept in cool ice boxes containing fragments of ice.

2.3 Media and Reagent for Bacteriological Study

Media used for bacteriological analysis were Plate Count Agar (PCA), MacConkey Agar (MCA), Mannitol Salt Agar (MSA). The commercial media were prepared according to the direction of the manufacturers and the non-commercial media were prepared in the laboratory.

The reagents used during the study were 0.1% peptone water, phosphate buffered saline (PBS), Phenol red, reagents for Gram's staining (crystal violet, gram's iodine, acetone alcohol, safranin etc.). The different types of glassware and appliances used during the course of the experiment were: Test tubes (with or without Durham's fermentation tubes and stopper), petridishes, conical flask, pipette (1 ml, 5 ml, 10 ml, 25 ml), slides and cover slips, hanging drop slide, glass rod spreader, test tube stand, Whirly mixture machine, blender machine, anaerobic glass jar, water bath, incubator, refrigerator, sterilizing instruments, hot air oven, ice boxes, electronic balance, compound microscope etc.

2.4 Preparation of Sample for Bacteriological Studies

Each of the samples was macerated in a mechanical blender using sterile diluents as per recommendation of International Organization for Standardizations (ISO, 1995). 10 (Ten) grams of the meat sample was taken aseptically with a sterile forceps and transferred into sterile containers containing 90 ml of 0.1% peptone water. A homogenized suspension was made in a sterile blender. Thus 1:10 dilution of the samples was obtained. Later on using whirly mixture machine different serial dilutions ranging from 10⁻² to 10⁻⁷ were prepared according to the standard method (ISO, 1995).
2.4.1 Enumeration of Total Viable Count (TVC), Total Coliform Count (TCC) and Total Staphylococcal Count (TSC)

For the determination of TVC/TCC/TSC, 0.1 ml of each ten-fold dilution was transferred and spread on duplicate PCA, MacConkey agar and Mannitol Salt Agar respectively using a fresh pipette for each dilution. The diluted samples were spread as quickly as possible on the surface of the plate with a sterile glass spreader. One sterile spreader was used for each plate. The plates were then kept in an incubator at 37°C for 24-48 hours. Following incubation, plates exhibiting <300 colonies were counted. The average number of colonies in a particular dilution was multiplied by the dilution factor to obtain the count. The count was calculated according to ISO (1995). The results of the count were expressed as the number of organism or colony forming units per gram (CFU/g) of meat sample. Then results were calculated into log value.

2.4.2 Gram's Staining

Gram's Method of staining was followed for the morphological and staining characteristic study of bacteria to provide information about the presumptive bacterial identification as per recommendation of Cowan (1985).

2.5 Survey on Hygienic Practices at Slaughter Houses

A survey was conducted at several upazila’s slaughter houses in Mymensingh district. Namely those were Bhaluka, Sadar, Phulpur, Trishal, Muktagachha, Ishwarganj and Fulbaria Upazila. The information was carried out from five butchers of a slaughter house in those particular Upazila.

2.6 Statistical Analysis

The data on Total Viable Count (TVC), Total Coliform Count (TCC) and Total Staphylococcal Count (TSC) obtained from the bacteriological examination of samples collected from different areas of Mymensingh were analyzed in completely randomized design (CRD) using computer package subjected to Analysis of Variance using WASP Software version 2.0.

3. Results

The objectives of microbiological quality control, whether carried out by the Government Inspection Services or industry, are mainly twofold: prevention of food borne disease and retardation of microbial spoilage.

3.1 Total Viable Count (TVC)

The mean value of the total viable count (TVC) in beef thigh meats of Shesmore market, Kewatkhal market, Mesoa Bazar and Choto Bazar are placed in Table 1. The variation of TVC in meats of different beef market was significant (P<0.01) as shown in Table 1. The maximum and minimum range of TVC in thigh meat recorded at Shesmore market, Kewatkhal market, Mesoa Bazar, Choto Bazar were 7.36, 7.04, 8.46 and 7.32, 6.95, 8.45 log CFU/g respectively.

3.2 Total Coliform Count (TCC)

The mean and standard deviation of the total coliform count (TCC) of beef meat processed at slaughter yards of Shesmore market, Mesoa Bazaar, Choto bazaar are placed in Table 1. The variation of TSC in meats of different market area was not significant (P>0.01). The interpretation of Total Staphylococcal Count in four different retail markets were not differed significantly (P>0.01). The maximum and minimum range of TSC in thigh meat recorded at Shesmore market, Kewatkhal market, Mesoa Bazar and Choto bazaar were 5.45, 5.45, 5.03, 6.45 and 5.35, 5.43, 4.38, 5.86 log CFU/g respectively. However the average value of TCC value in Mesoa Bazaar was lower and it is highest in Shesmore market.

3.3 Total Staphylococcal Count (TSC)

The mean values of Total Staphylococcal Count (TSC) in beef meat of four different area like Shesmore market, Kewatkhal market, Mesoa Bazaar, Choto bazaar are placed in Table 1. The maximum and minimum range of TSC in meats of different market area was not significant (P>0.01). The interpretation of Total Staphylococcal Count in four different retail markets was not differed significantly (P>0.01). The maximum and minimum range of TSC in thigh meat recorded at Shesmore market, Kewatkhal market, Mesoa Bazar and Choto bazar were 5.45, 5.45, 5.03, 6.45 and 5.35, 5.43, 4.38, 5.86 log CFU/g respectively. However the average value of TSC at four markets were log 5.40, 5.44, 4.70 and 6.15 as shown in Table 1. The TSC value in Mesoa Bazaar was lower and it is highest in Choto bazaar.

3.4 Correlation with TVC, TCC and TSC in Seshmore Market, Kewatkhali Mesoa Bazaar and Choto Bazaar

The result estimated weakly negative correlation between the total viable count and total coliform count. In this study, viable counts were not significantly correlated with total coliform count in three market area (Fig 1). The result shown in Fig 2 revealed that the regression was positively correlated with Total Viable count and Total Staphylococcal Count in different market, where correlation coefficient was R²=0.0005.

The result shown in Fig 3 revealed that the regression was strongly positive correlated with Total Coliform count and Total Staphylococcal Count in different market, where correlation coefficient was R² = 0.49 and regression equation was y = -12.02x - 35.37 respectively. Hence the increase of TVC will enhance by the increase of TSC abruptly the decrease of TVC will be decrease with the TSC count (Fig 3).
Table 1: Bacterial Count Beef (CFU/gm)

<table>
<thead>
<tr>
<th>Retail Market</th>
<th>TVC</th>
<th>TCC</th>
<th>TSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shesmoor Market</td>
<td>7.34±0.02</td>
<td>3.37±0.01</td>
<td>5.4±0.05</td>
</tr>
<tr>
<td>Kewatkhali Market</td>
<td>6.99±0.05</td>
<td>3.35±0.01</td>
<td>5.44±0.01</td>
</tr>
<tr>
<td>Meosa bazaar Market</td>
<td>8.46±0.01</td>
<td>3.36±0.04</td>
<td>4.74±0.33</td>
</tr>
<tr>
<td>Choto bazaar Market</td>
<td>8.43±0.01</td>
<td>3.24±0.02</td>
<td>6.19±0.30</td>
</tr>
</tbody>
</table>

Level of sig. * NS *

TVC= Total Viable Count, TCC= Total Coliform Count, TSC= Total staphylococcal Count, *=Significant at 5% level

Table 2: Bacterial Count in meat products (CFU/gm)

<table>
<thead>
<tr>
<th>Meat Products</th>
<th>Market</th>
<th>TVC</th>
<th>TCC</th>
<th>TSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken Toast</td>
<td>K.R</td>
<td>7.43±0.04</td>
<td>3.56±0.03</td>
<td>5.44±0.02</td>
</tr>
<tr>
<td>Town</td>
<td>7.09±0.07</td>
<td>3.12±0.05</td>
<td>5.22±0.04</td>
<td></td>
</tr>
</tbody>
</table>

Level of significance * NS *

| Burger         | K.R    | 7.45±0.04 | 2.93±0.01 | 5.45±0.02 |
| Town           | 7.08±0.08  | 2.33±0.35  | 5.28±0.03  |

Level of significance * NS *

| Hotdog         | K.R    | 6.99±0.05 | 3.93±0.43 | 5.41±0.02 |
| Town           | 6.47±0.15  | 3.33±0.15  | 4.93±0.04  |

Level of significance * NS *

TVC= Total Viable Count, TCC= Total Coliform Count, TSC= Total staphylococcal Count, *=Significant at 5% level

Table 3: Result of the Survey

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Categories</th>
<th>Mymensingh District (n=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge on Hygienic meat production</td>
<td>Know</td>
<td>5.71%</td>
</tr>
<tr>
<td></td>
<td>Partially know</td>
<td>57.14%</td>
</tr>
<tr>
<td></td>
<td>Do not know</td>
<td>37.15</td>
</tr>
<tr>
<td>Pre slaughter Inspection</td>
<td>Yes</td>
<td>45.71%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>54.29%</td>
</tr>
<tr>
<td>Meat Inspection by Veterinarian</td>
<td>Yes</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>100%</td>
</tr>
<tr>
<td>Drainage system</td>
<td>Proper</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Not proper</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>Not available</td>
<td>25%</td>
</tr>
<tr>
<td>Washing Facilities</td>
<td>Proper</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Not proper</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Not available</td>
<td>13%</td>
</tr>
</tbody>
</table>

3.5 Total Viable Count (TVC) in Meat Products

The mean value of the total viable count (TVC) in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets are shown in Table 2. The maximum range of TVC in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets recorded were 7.46, 7.48, 7.03 and 7.15, 7.15, 6.63 log CFU/g respectively, while minimum range of TVC in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets recorded were 7.39, 7.41, 6.94 and 7.02, 7.00, 6.32 log CFU/g. However the average value of TVC in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets were 7.43, 7.45, 6.99 and 7.09, 7.08, 6.48 log CFU/g.

3.6 Total Coliform Count (TCC) in Meat Products

The mean value of the total coliform count (TCC) in meat products (only in Hotdog) of K.R and Mymensingh city markets are placed in Table 2. The variation of TVC in meat products of different market was significant (P<0.01) at 1% level of significance. The maximum range of TCC in meat products (only in Hotdog) of K.R and Mymensingh city markets recorded
were 3.95 and 3.39 log CFU/g respectively. While minimum range of TVC in meat products (only in Hotdog) of K.R and Mymensingh city markets recorded were 3.90 and 3.30 log CFU/g respectively. However the average value of TCC in meat products (only in Hotdog) of K.R and Mymensingh city markets were 3.95 and 3.35 log CFU/g.

3.7 Total Staphylococcal Count (TSC) in Meat Products
The mean value of the total viable count (TSC) in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets are shown in Table 2. The variation of TSC in meat products of different market was significant (P<0.05) at 5% level of probability as shown in Table 2. The result of Total Viable Count in three different markets were differed significantly (P<0.05). The maximum range of TSC in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets recorded were 5.46, 5.47, 5.43 and 5.25, 5.30, 4.97 log CFU/g respectively. While minimum range of TSC in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets recorded were 5.43, 5.44, 5.39 and 5.18, 5.25, 4.90 log CFU/g respectively. However the average value of TSC in meat products (Chicken Toast, Burger, Hotdog) of K.R and Mymensingh city markets were 5.45, 5.46, 5.41 and 5.22, 5.28, 4.94 log CFU/g.

3.8 Correlation with TVC, TCC and TSC in K.R and Mymensingh City Markets

The results shown in Fig 1 declare positive correlation between the TVC and TCC. In this study, TVC were significantly correlated with TCC in market area. The regression equation and correlation coefficient value was $R^2 = 0.88$ as shown in Fig 1. The result estimated in Fig 2 showed positive correlation between the TVC and TSC. In this study, TVC were significantly correlated with TSC in market area. The regression equation and correlation coefficient values was $R^2 = 0.80$. The result estimated in Fig 3 showed positive correlation between TCC and TSC. In this study, TVC were significantly correlated with TCC in market area. The regression equation and correlation coefficient values were, $y= 0.80x + 2.27$, and $R^2 =0.98$.


Producers are not sincere enough to produce hygienic meat; they don’t know how to produce hygienic meat. Only 5.71% people have the knowledge on hygienic meat production. About 57.14% have the partial knowledge on hygienic meat production. Among all about 37.14% don’t have any knowledge on hygienic meat production. About 54.29% people don’t follow Pre-slaughter inspection. Meat inspection by Veterinarian doesn’t maintain after slaughtering the animals. Proper drainage system and washing facilities are also ignored, about 25.5% slaughter house have no available drainage system and about 14% slaughter house have no available washing system. These are the major consideration for producing quality and safety meat. TVC, TCC and TSC are very much inversely related with these poor maintenances.

4. Discussion
4.2 Total Coliform Count (TCC)

The mean value of TCC per gram in meats of Seshmore market and Mesoa Bazaar were log 3.37 and log 3.36 CFU/gm respectively and in Kewathkali market and Mesoa Bazaar TCC was absent. In meat products (only in Hotdog) the mean values of TCC per gram of meat sample of K.R and Mymensingh city Market were found 3.93 and 3.33 log CFU/g respectively. In this analysis in hotdog TCC was higher in K.R market than Mymensingh city market. So K.R market meat products (hotdog) are not so good like Mymensingh city market. The variation of TCC in meats of different beef market is not significant (P>0.01) at 1% level of probability as shown in Table 2. Nevertheless no significant variation was demonstrated between the interactions of the markets. The interpretation of TCC in different retail markets...
were not differ significantly (P>0.05). In the present study the values of TCC of different carcass from different retail markets exceeded the prescribed standard of ICMSF is 4.50 log CFU/g. The higher coliform count in meats of different markets revealed the fact that the product was subjected to fecal contamination where poor sanitary measures were practiced. The high coliform counts in meat of Seshmore market might be suggested that the carcass were exposed to varied sources of contamination where possible. The lower coliform was recorded in Kewatkhal for its maintaining proper hygiene and sanitary measure. The coliform counts were always higher in thigh region. The significance of higher coliform count in thigh might be reflected the opinion that this part of the carcass was more subjected to exposure and contamination with the fecal materials during handling, and processing of the carcass. Coliform are present on the feathers and intestinal contents of live animal. The number of coliforms found in the cavity tended to be higher than the number found on the outer meat and skin surfaces. Since coliforms can multiply outside the animal body, their presence in high numbers in a food product may not be indicator of original contamination, but of improper handling, which allowed multiplication of the organisms.

4.3 Total Staphylococcal Count (TSC)

Seshmore market, Kewatkhal market, Mesoa Bazaar, Choto Bazaar have the TSC values of 5.40, 5.44, 4.74 and 6.19 log CFU/g respectively. Similarly in meat products (chicken toast, burger and hotdog) the mean values of TVC per gram of meat sample of K.R and Mymensingh city market were found 5.44, 5.45, 5.41 and 5.22, 5.28, 4.93 log CFU/g respectively. In this analysis in case of chicken toast TSC was higher in K.R market than Mymensingh city market, in the burger TSC was higher in K.R market than Mymensingh city market and finally in the hotdog TSC was higher in K.R market than Mymensingh city market. So K.R market meat products are not as good as Mymensingh city market. The principal source of contaminating beef carcass includes hands of butchers, clothes, boiler, wiping cloths, tools of butchers, knives, skin, eviscerating etc. The organisms have been isolated from 50% of the apparently normal healthy individuals. In Seshmore market the value of TCC in meat was lower but it was highest in Choto Bazaar.

The interpretation of TSC in different retail markets were not differed significantly (P>0.05). Positive correlation and significant variation of TSC was found in different retail. This signifies the fact that all these meats are more or less handled in the same manner. Staphylococcal food poisoning results from eating food contaminated with toxins produced by certain types of *Staphylococci*, resulting in diarrhea and vomiting (Boyce, 2012).

4.4 Correlation between TVC, TCC and TSC of different Market in Meat Products

In this study, TVC did not significantly correlated with TCC in meats of Seshmore market, Kewatkhal market, Mesoa Bazaar, Choto Bazaar area (P>0.01). The result in Fig 2 reveals that the regression was positively correlated with TVC and TSC in meats of different market area (P<0.01). The result presented in Fig 2 showed positively and significantly correlated between the viable count (TSC) and TCC in meats of Seshmore market, Kewatkhal market, Mesoa Bazaar, Choto Bazaar respectively. This result is also agreement with the observation of Notermans et al. (1975). The interpretation of TSC in different retail markets were not differing significantly. This result correlated with Singh et al. (1984).

A weak relation is observed in TVC and TCC in meats of different markets. The result estimated in Fig 6 showed positively correlation between the TVC and TSC in meat of markets. TSC value will be increased with the decrease of TVC value. The findings are closely similar to Adu-Gyamfi et al. (2012) and Chaiba et al. (2007). The result revealed that the regression equation of TVC was negatively and weakly correlated with TCC. TVC and TSC positively correlated and in meats of Seshmore market, Kewatkhal market, Mesoa Bazaar, Choto Bazaar. This result was agreement with the observations of Bodhidatta et al. (2010). The regression equation and correlation coefficient values was $R^2 = 0.99$. Here also the TSC value will increase with the increase of TVC value.

The present study demonstrates the degree of the microbial contamination during processing. The results also indicated that the viable count for micro organisms causing public hazards is appropriate for analysis. Therefore, application of hygienic measurements appears to be important to reduce the contamination of bacteria in abattoirs as well as in products processing plant. So the implementation of Hazard Analysis and Critical Control Points (HACCP) in this sphere is extremely important, because it involves the constant monitoring of all steps of the process.

5. Conclusion

This study was conducted to assess the microbial quality of beef meat and meat products that are sold in different retail markets situated in Mymensingh. The principal objective was to evaluate the microbial quality of different beef thigh meat and meat products and find out incidence of different kinds of pathogenic bacteria gaining access to meat samples in various densities which are responsible for public health implications. The results also indicated that the viable count for microorganisms causing public hazards is appropriate for analysis. Therefore, application of hygienic measurements appears to be important to reduce the contamination of bacteria in abattoirs. So the implementation of Hazard Analysis and Critical Control Points (HACCP) in meat industry is extremely
important, because it involves the constant monitoring of all steps of the process.

References


WASP software - *Web Agri Stat Package 2.0*.