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Food safety knowledge and practices of abattoir and butchery shops and the microbial profile of meat in Mekelle City, Ethiopia

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PEER REVIEW

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Comments

This is a good study in which the authors evaluated meat handling system, the bacterial load, major bacterial pathogens that were found in the city abattoir, butchery shop and street meat sale. The results are interesting which suggested that the meat supplied to the consumers in the city is not of good hygienic quality.
(Details on Page 411)

ABSTRACT

Objective: To assess the food safety knowledge and practices in meat handling, and to determine microbial load and pathogenic organisms in meat at Mekelle city. **Methods:** A descriptive survey design was used to answer questions concerning the current status of food hygiene and sanitation practiced in the abattoir and butcher shops. Workers from the abattoir and butcher shops were interviewed through a structured questionnaire to assess their food safety knowledge. Bacterial load was assessed by serial dilution method and the major bacterial pathogens were isolated by using standard procedures. **Results:** 15.4% of the abattoir workers had no health certificate and there was no hot water, sterilizer and cooling facility in the abattoir. 11.3% of the butchers didn't use protective clothes. There was a food safety knowledge gap within the abattoir and butcher shop workers. The mean values of bacterial load of abattoir meat, butcher shops and street meat sale was found to be 1.1×10^5, 5.6×10^5 and 4.3×10^6 cfu/g, respectively. The major bacterial pathogens isolated were *Escherichia coli*, *Staphylococcus aureus* and *Bacillus cereus*. **Conclusions:** The study revealed that there is a reasonable gap on food safety knowledge by abattoir and butcher shop workers. The microbial profile was also higher compared to standards set by World Health Organization. Due attention should be given by the government to improve the food safety knowledge and the quality standard of meat sold in the city.

KEYWORDS

Abattoir, Bacterial load, Bacterial, Isolation butchery shops, Hygiene, Street meat sale, Mekelle

1. Introduction

Food borne diseases occur commonly in developing countries particularly in Africa because of the prevailing poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest in safer equipment and lack of education for food-handlers[1]. Of the foods intended for humans, those of animal origin tend to be most hazardous unless the principles of food hygiene are employed. Animal products such as meats, fish and their products are generally regarded as high-risk commodity in respect of pathogen contents, natural toxins and other possible contaminants and adulterants[2]. Bacterial contamination of meat products is an unavoidable consequence of meat processing[3]. Even if data regarding meat borne diseases in Ethiopia are extremely scarce, a few studies conducted in different parts of the country have shown the public health importance of several bacterial pathogens associated with foods of animal origin[4-8].

Mekelle, the capital city of Tigray Regional State, Ethiopia is presently experiencing rapid growth. As a result, the

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number of commercial food establishments in the city has been visibly increasing. Currently, there are about 110, 308, 292 registered butcher shops, cafeterias and restaurants, respectively. The source of meat for all these commercial food establishments is the Mekelle city municipal abattoir. Additionally, this abattoir provides meat requirements of higher institutions and military camps. On an average of 40-65 male cattle are slaughtered daily during non-fasting days. However, the available quality of the city abattoir is below standard. This is because the abattoir was constructed 50 years ago considering the population of 15 000 of the city at the time and also the abattoir had no basic facilities like stunning, bleeding, evisceration and cooling rooms. The current population of the city is around 215 546, and there is an increased demand for foods of animal origin[9]. No comparable data was available regarding the assessment of food safety practice, food borne diseases and microbial load of meat in the abattoir and butchery shops of the city. These factors could hinder governments' ability to accurately apply measures on the impact of food contamination problems on public health. Therefore, the present study was designed to assess the food safety knowledge and practices in meat handling, and to determine microbial load and pathogenic organisms in meat in Mekelle.

2. Materials and methods

2.1. Study area

The assessment survey was carried out from September to December in 2010 in Mekelle butcher shops and municipality abattoir in Tigray Regional State where cattle are brought from different provinces and districts for slaughter. Mekelle is the capital city of the region situated about 783 km North of Addis Ababa at 38.5° East longitude and 13.5° North latitude at an altitude of 2 300 meters above sea level. The climate conforms to that of the Ethiopian highland. The city has six sub-cities and a total population of 215 546[9], which is home to over 800 grain mills, 308 cafeterias, 292 restaurants, 258 supermarkets and an active urban-rural exchange of goods which has 30 000 micro- and small enterprises[10].

2.2. Study design

A descriptive survey design was used to answer questions concerning the current status of food hygiene and sanitation practiced in the abattoir and butchery shops. Hygiene and sanitation was determined by the use of structured interview and through direct observations of the hygienic status and practices by abattoir and butcher shop workers. Bacteriological analysis of meat with the intention of colony count and identifying pathogenic bacteria were conducted to supplement the sanitary survey. The target population constituted all the owners of meat shops in the city as well as the abattoir workers.

2.3. Sample collection

Random sampling strategy was followed. Due to the limited resource to include all the butcher shops in the study, 5 butcher shops were randomly selected out of 15-20 butcher shops available in the six sub-cities (*i.e.* a total of 30 butcher shops out of the existing 110 were included in the study which accounts for about 27.3% of the total size). Three fresh minced meat samples were purchased from the selected butcher shops at different times. The source of meat in the butcher shop was either from the city abattoir or from the backyard slaughter. Five meat samples were also collected from the city abattoir and from the street meat sales shops separately. The samples were collected aseptically in a clean polyethylene bag once a week for consecutive 8 weeks and transported within 3 h to the laboratory in icebox for further bacteriological analysis as described by the methods of Fawole and Oso[11]. A total of 100 meat samples were collected to assess the microbial load. Samples were examined upon arrival to the laboratory or were kept in refrigerator until processed for a maximum of 48 h.

2.4. Enumeration of total viable count and isolation of bacteria

Ten gram of each meat sample was weighed out and homogenized into 90 mL of sterile distilled deionized water using a sterile homogenizer (Silverson, France). From the 10-fold dilutions of the homogenates; 0.1 mL of 10^{-2}, 10^{-3} and 10^{-4} dilutions of the homogenates were plated in replicate on standard plate count agar, using pour plate method. The plates were then incubated at 37 °C for 24-48 h. At the end of the incubation period, colonies were counted using the illuminated colony counter. The counts for each plate were expressed as colony forming unit of the suspension (cfu/g). Bacterial isolation was performed using nutrient agar (NA) and peptone water (PW) as general and enriched media and other media with selective and differential characteristics. All media were prepared according to the manufacturer's (Himedia, India) specification and suspected samples were inoculated on Mac Conkey agar, eosin methylene blue agar, Edward's medium and Mannitol salt agar. Plates were incubated at 37 °C for 24-48 h. Discrete colonies were subcultured into fresh agar plates aseptically to obtain pure cultures of the isolates. Pure isolates of resulting growth were then stored at 4 °C and used for further identification of bacteria.

2.5. Identification of bacteria

Colonies identified as discrete on nutrient agar were carefully examined macroscopically (Olympus light microscope, Germany) for cultural characteristics such as the shape, color, size and consistency. Gram staining as well as appropriate biochemical tests was carried out according to standard procedures[12]. The isolates were identified by comparing their morphological and biochemical characteristics (catalase, oxidase, coagulase, indole, urease, sugar tests) with standard reference organisms with those of known taxa, as described by Bergey's Manual for Determinative Bacteriology[13].

2.6. Statistical analysis

Data were analyzed through Statistical Package for Social