Isolation, Identification, and Antibiogram of Staphylococcus from Paper Currency and Meat Collected from Butcher House, Restaurant and Abattoir in Jimma Town, South Western Ethiopia

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Research Article

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Abstract

Background: *Staphylococcus* infections remains a global problem and cause significant morbidity and mortality both in animals and humans. Contaminated meat and paper currency surfaces play a key role in the spread of bacterial infections with antibiotic resistance.

Methods: A cross-sectional study was conducted with the objective of isolation and identification of *Staphylococcus* species from Ethiopian paper currency notes and raw meat handled by the butcher, restaurant and abattoir workers and to determine antimicrobial susceptibility test. A total of 243 samples (135 raw types of meat and 108 paper currency) were examined by biochemical tests for the presence of *Staphylococcus* species.

Results: From a total of 243 collected samples, 26.7% and 64.8 % were found positive isolates of raw meats and paper currency notes respectively. An overall prevalence of 43.6%(106) was recorded. The highest prevalence was observed 39(72.2%) in Hermata merkato kebele whereas the lowest was 3 (11.1%) in Ifabula. Variation within the source of the sample was statistically significant (P<0.05). Of these isolates, 30 selected isolates were tested for antibiotic susceptibility test. Thirty(100%) isolates were susceptible to chloramphenicol. There is no isolate that was sensitive to all four selected antimicrobials (Penicillin G, Gentamycin, chloramphenicol, and Tetracycline). Six isolates of meat (50%) were resistant to penicillin G. which indicates its emerging animal and public health problem.

Conclusions: The finding indicated the presence of antibiotics resistance *Staphylococcus* species contamination of meat and paper currency birr. Awareness creation is paramount important for people working on the food chain to reduce cross contamination of food and prevent foodborne intoxication.

Introduction

Paper currency refers to notes of different denominations made of paper and issued by the central bank or the government of a country. Globally, paper currency is widely exchanged for goods and services [1–3]. However, the combination of its widespread use and its constant exchange make the paper currency a likely agent for disease transmission. The Ethiopian currency called “Birr” is the second most used currency in Africa after the Nigerian “Naira” for goods and services, including food and others, exchanged in Ethiopia as in most other countries worldwide [4–5]. Microbial contamination of paper currency could be from several sources, it could be from the counting machine, atmosphere, during storage, usage, handling, or production [6–7].

The raw materials from which paper currencies are made also play a significant role in harboring high microbial load. As studies have shown, those paper currencies that are made of a mixture of cotton and linen usually offer a surface area for microorganisms to reside on both sides [8]. However, polymer-based paper currencies presented lower bacterial counts than cotton-based paper currencies [9]. Further, the longer the paper currencies remain in circulation, the more chance there is for them to become
contaminated, and lower-denomination notes receive the most handling because they are exchanged more frequently [8–9].

Meat is a nutrient-rich food that provides a vital amount of proteins, vitamins and minerals with greater bioavailability than other food sources [10]. However, it has been recognized as the main vehicle for the transmission of food-borne pathogens to humans [11–12]. The safety of meat may be affected by many biological, chemical and physical hazards; although the biological hazards pose the highest food-borne risk for meat consumers [11]. From the biological hazards, bacterial pathogens are the most serious concern [13]. Food items can cause serious problems when they are contaminated with harmful microorganisms due to a lack of proper sanitary conditions, hygiene practices, and proper storage [14].

Extensive research review revealed infected fomites or currency surfaces play a key role in the spread of bacterial infections with antibiotic resistance [15]. People living in unhygienic conditions with unhygienic practices will contaminate the paper currencies with microorganisms course of improper hand washing after using the toilet, counting paper currencies using saliva, coughing and sneezing on hands subsequently exchanging currencies, and placement or storage of paper currencies on dirty surfaces leads to the contamination and these currencies will act as a vehicle delivering microorganisms to contaminate the hands of the next user. Consequently, paper currencies have a significant role in the transmission of pathogenic microorganisms and present a sensible risk to public health [16]. It is generally documented that the physical transfer of material from hands, surfaces, and the environment can contaminate paper currencies since almost every socio-economic setting regularly hold and transfer paper currencies [17].

Antibiotic sensitivity testing against a pathogen bacteria is often necessary in order to determine the effective drug of choice to kill bacteria. This art is crucial because antimicrobial susceptibility patterns cannot be predicted and the emergence of drug resistance is being reported frequently in the world [18].

Investigations into the contamination of paper currencies with microorganisms are scarce in most of developing countries. Consequently, the shortage of information may contribute to the absence of public health policies regarding currency usage, handling and circulation [19]. Data regarding the degree to which paper money is contaminated with bacteria are few. Moreover, *Staphylococcus* carriage of Ethiopian paper currency notes handled by meat sellers (butcher), restaurants and abattoir workers were not yet assessed and the isolates were not also tested for drug susceptibility in Jimma town. Thus, the aims of this study were:

- To assess the contamination rate of Ethiopian paper currency notes and raw meat handled by meat sellers (butcher), restaurants and abattoirs with *Staphylococcus*.
- To determine antimicrobial susceptibility test on these selected isolates from Jimma town

**Materials And Methods**
Study Area

This study was conducted in the Jimma zone specifically in Jimma town. Jimma town is located in the Oromia region, at a distance of about 352 km from Addis Ababa in the southwest. Jimma is located at 7°13’ and 8°56’ N latitude and 35°52’ and 37°37E longitude. The climatic condition of the area is ‘Woynadega’ with an altitude ranging between 1720 to 2110m above sea level and receives annual rainfall which ranges between 1200 to 2000mm. The annual mean temperature ranges from about 12.1°C to 28°C [20].

Study Population and Design

The target populations for this work were butcher houses, restaurants and abattoir. The Commercial Bank of Ethiopia Jimma branch was also included for control purposes. A cross-sectional study design was conducted from October 2018 to March 2019 to isolate and identify *Staphylococcus species* from Ethiopia paper currency notes Birr (ETB) and raw meat handled by meat sellers (butchers), restaurants and abattoir workers located in Jimma town. The butcher houses and restaurants were selected by simple random sampling technique and the abattoir was selected purposively because only one abattoir was present.

Sample Size Determination

The sample size for paper currency notes and raw meat samples was calculated according to [21]. In the study area, there was a previous study conducted on *staphylococcus aureus* with a prevalence rate of 19.8%, thus 19.8% was considered as the expected prevalence for sample size determination. A 95% confidence interval and 5% desired absolute precision was considered. Accordingly, the calculated sample size for this study was 243 (108 Ethiopian paper currency notes (birr) and 135 types of meat samples).

Study Methodology

Samples Collection: The paper currency notes and raw meat were collected from meat sellers at butchers, restaurants and abattoirs. A random of birr 5, birr 10, birr 50 and birr 100 and raw meat samples were collected. A total of 108 ETB notes were collected. In addition, 10 of each newly minted paper currency notes were directly collected from the commercial bank of Ethiopian Jimma main Brach for the control group. All samples were collected aseptically by letting the selected individual drop random currency notes into 4 separate sterile polythene bags while substitution with equal amounts of paper currency and raw meat samples were dropped in bottles. A total of 135 meat samples were collected after permitting the managers. Then the polythene bags and the meat sample were promptly labeled, sealed and transported in an icebox to the Microbiology Laboratory, College of Agriculture and Veterinary Medicine, Jimma University.

Laboratory Analysis
Paper currency sample preparation: Both surfaces of each sampled currency were thoroughly swabbed aseptically using sterile Buffered Peptone Water (BPW) (Merck, Germany) soaked cotton on pre-sterilized aluminum foil. The swab was dipped into 10 ml BPW and incubated for 24hrs at 37°C. The selective medium used for the isolation of *Staphylococcus* was mannitol salt agar. A loopful of inoculum from buffered peptone water was streaked on mannitol salt agar and incubated at 37°C for 24 hours. After that characteristic colonies usually occur in 24 hours [22].

Meat sample preparation: After the samples arrived at analyzing center a ten-gram of solid meat sample was weighed and aseptically taken and cut aseptically by using a sterilized surgical blade then put into a sterile beaker containing 90ml sterile buffered peptone water. It was homogenized at 3000 rpm for 5-10 min. 1ml aliquot of homogenate was transferred to a test tube containing 9ml sterile distilled water to make 10 − 2 dilutions and shaken well with a vortex mixer (Digosystem, VM-1000, Taiwan). Serial dilutions up to 10 − 5 were prepared for the microbiological analysis. Diluted meat samples in normal saline were spread onto mannitol salt agar and incubated at 37°C for 24 hrs.

Morphological characteristics: The smear was prepared from the isolated culture on clean grease-free microscopic glass slide and stained with Gram's method of staining. The stained smear was observed under a microscope. The smear revealed Gram-positive, spherical cells arranged in irregular clusters resembling a bunch of grapes. They are round, cocci shaped. The pigmentation of *S. aureus* strain has a golden yellow pigment but *S. intermedius* and *S. hyicus* are non-pigmented. Biochemical examination: The pure cultures were streaked on Nutrient agar (HiMedia Pvt. Ltd.) and incubated for 24 hours at 37°C and were further characterized by biochemical tests to confirm *Staphylococcus spp* using Gram staining, Catalase test, Coagulase test, citrate test, TSI test and D-mannitol fermentation [23].

**Data Analysis**

Data generated from laboratory investigations were recorded and coded using a Microsoft Excel spreadsheet (Microsoft Corporation) and exported to SPSS, analyzed using SPSS version 20 statistical software. The P-value was used to determine the presence of association among the different variables and the major cause of health problems caused by contamination. A p-value less than 0.05 were considered as having statistically significant. For this, a logistic regression model and a 95% confidence interval were used for interpreting the association between dependent and independent variables.

**Ethical clearance**

The study was conducted after it was ethically reviewed and approved by the concerned body, then a letter informing the concerned bodies was written from the college. All the information obtained from the study participants was coded to maintain confidentiality and data was collected after written informed consent was obtained. The finding of this research was timely reported to the concerned body for appropriate intervention.

**Results**
The result showed that out of the 243 samples of meats (135) and (108) birr examined; 106 of the meat and 70 of the Ethiopian currency paper samples were contaminated with *Staphylococcus*. The overall prevalence of *Staphylococcus* species in the study area was found to be 43.6% with a specific prevalence of 26.7% for meat and 64.8% for the birr samples. The prevalence of *Staphylococcus* species isolated was higher in a sample in Hermata merkato kebele (72.2%) compared with other kebeles (Table 1).

<table>
<thead>
<tr>
<th>Variables</th>
<th>No examined samples</th>
<th>No positive samples</th>
<th>Percent of Isolates (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kebeles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginjo Gudurru</td>
<td>54</td>
<td>20</td>
<td>37</td>
</tr>
<tr>
<td>Bacho-bore</td>
<td>54</td>
<td>22</td>
<td>40.7</td>
</tr>
<tr>
<td>Hermata Merkato</td>
<td>54</td>
<td>39</td>
<td>72.2</td>
</tr>
<tr>
<td>Hermata Mentina</td>
<td>54</td>
<td>22</td>
<td>40.7</td>
</tr>
<tr>
<td>Ifa-bula</td>
<td>27</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Type of Sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw Meat</td>
<td>135</td>
<td>36</td>
<td>26.7</td>
</tr>
<tr>
<td>Paper currency (Birr)</td>
<td>108</td>
<td>70</td>
<td>64.8</td>
</tr>
<tr>
<td>Source of Samples</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butcher House</td>
<td>125</td>
<td>67</td>
<td>53.6</td>
</tr>
<tr>
<td>Restaurant</td>
<td>91</td>
<td>36</td>
<td>39.6</td>
</tr>
<tr>
<td>Abattoir</td>
<td>27</td>
<td>3</td>
<td>11.1</td>
</tr>
<tr>
<td>Control group</td>
<td>40</td>
<td>1</td>
<td>2.5</td>
</tr>
</tbody>
</table>

The prevalence rate of *Staphylococcus species* in paper currency (64.8%) is higher than that of raw meat (26.7%); there were statistically significant differences observed (P < 0.05) between sample types. The Source of the sample was found to be positively associated with *Staphylococcus species* at (P < 0.5); butcher houses were more likely to test positive than restaurants and abattoir. However, one paper currency was positive for *Staphylococcus species* from samples collected from Jimma commercial bank and examined as a control group in paper currency (Table 2).
The prevalence of *staphylococcus* species was different in different types of samples, it was found that in raw meat 16(11.9%) *S. aureus*, 8(5.9%) *S. intermedius*, 6(4.4%) *S. hyicus* and 6(4.4%) *S. epidermidis*; and in case of paper currency 34(31.5%) was *S. aureus*, 15(13.9%) was *S. intermedius*, 15(13.9%) was *S. hyicus* and 7(6.5) was *S. epidermidis*. The result showed that there was a higher prevalence of *staphylococcus aureus* than other staphylococcus *species* in both meat and paper currency (Table 3).

<table>
<thead>
<tr>
<th>Variables</th>
<th>No Isolates</th>
<th>P-value</th>
<th>Odd ratio</th>
<th>95% CI</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kebeles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginjo Gudurru</td>
<td>20(37)</td>
<td>0.02</td>
<td>0.212</td>
<td>0.057</td>
<td>0.796</td>
<td></td>
</tr>
<tr>
<td>Bacho-bore</td>
<td>22(40.7)</td>
<td>0.01</td>
<td>0.182</td>
<td>0.049</td>
<td>0.679</td>
<td></td>
</tr>
<tr>
<td>Hermata Merkato</td>
<td>39(72.2)</td>
<td>0.00</td>
<td>0.048</td>
<td>0.013</td>
<td>0.184</td>
<td></td>
</tr>
<tr>
<td>Hermata Mentina</td>
<td>22(40.7)</td>
<td>0.01</td>
<td>0.182</td>
<td>0.049</td>
<td>0.679</td>
<td></td>
</tr>
<tr>
<td>Ifa-bula</td>
<td>3(4.4)</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw Meat</td>
<td>36(26.7)</td>
<td>0.00</td>
<td>0.197</td>
<td>0.114</td>
<td>0.342</td>
<td></td>
</tr>
<tr>
<td>Paper currency (Birr)</td>
<td>70(64.8)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source of Samples</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butcher House</td>
<td>67(53.6)</td>
<td>0.000</td>
<td>0.108</td>
<td>0.031</td>
<td>0.378</td>
<td></td>
</tr>
<tr>
<td>Restaurant</td>
<td>36(39.6)</td>
<td>0.011</td>
<td>0.191</td>
<td>0.054</td>
<td>0.681</td>
<td></td>
</tr>
<tr>
<td>Abattoir</td>
<td>3(11.1)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With regard to antimicrobial resistance pattern, 30 purposive selected positive isolates of *Staphylococcus* were screened for antimicrobial susceptibility tests against four antimicrobials. All the serotypes isolated from both samples were susceptible to Chloramphenicol however, the rest of the isolates from meat and birr samples were resistant to one or more antimicrobials. There is no isolate that was sensitive to all four selected antimicrobials (Table 4).

### Table 3

<table>
<thead>
<tr>
<th>Samples</th>
<th><em>S. aureus</em></th>
<th><em>S. intermedius</em></th>
<th><em>S. hyicus</em></th>
<th><em>S. epidermidis</em></th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>16(11.9%)</td>
<td>8(5.9%)</td>
<td>6(4.4%)</td>
<td>6(4.4%)</td>
<td>26.7%</td>
</tr>
<tr>
<td>Birr</td>
<td>34(31.5%)</td>
<td>15(13.9%)</td>
<td>15(13.9%)</td>
<td>7(6.5%)</td>
<td>64.8%</td>
</tr>
</tbody>
</table>

**Key:** *S. staphylococcus*
Table 4
Multidrug resistance patterns of *staphylococcus* isolate against sample type

<table>
<thead>
<tr>
<th>Variables</th>
<th>Meat (%)</th>
<th>Birr (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin G</td>
<td>16.7 (S);33.3(I); 50.0 (R)</td>
<td>61.1 (S);11.1 (I); 27.8 (R)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>58.3 (S);33.3(I); 8.3 (R)</td>
<td>50.0 (S);38.9 (I); 11.1 (R)</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>100.0 (S);0.0 (I); 0.0 (R)</td>
<td>100.0 (S);0.0 (I); 0.0 (R)</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>41.7(S);25.0 (I); 33.3 (R)</td>
<td>66.7 (S);27.8 (I); 5.6 (R)</td>
</tr>
</tbody>
</table>

**Key**: I: intermediate; S: sensitive; R: resistant

Discussion

*Staphylococcus species* have been frequently isolated from raw meat samples with reports of significant toxin production implicated in food poisoning cases. In the present study, *Staphylococcus species* isolates were detected with a prevalence rate of 26.7% from meat and 64.8% from the paper currency in Jimma town. The contamination of staphylococcus species was higher in paper currency birr (64.8) than in meat (26.7) this may be due to the high circulation rate of paper currency in the market as almost all Ethiopians used cash for economic exchange and the traditional habit of using saliva during the counting of money. Moreover, Poor personal hygiene and handling practices of the meat salespersons could contribute to the occurrence of contamination in the areas.

Of the all, paper currency samples evaluated in the present study, 64.8% prevalence was contaminated with *staphylococcus* species. The presence of *staphylococcus* on ETB was higher in that were handled by butcher houses (53.6%) than restaurants (39.6%). This high prevalence of *staphylococcus* in butcher houses is due to meat sellers collecting money from buyers with hands contaminated with blood and animal tissues [24]. Moreover, the meat contamination may be from a knife or from a cutting table or due to poor hygiene during the processing of meat. This result indicated the likelihood of public infection with this pathogenic *staphylococcus* strain through meat bought from butcher houses.

The prevalence of *Staphylococcus aureus* was (31.5%) isolated from paper currency. It was in agreement with (34.06%) reported from Ethiopia by [4]. *Staphylococcus spp.* is found ubiquitously distributed in the environment and strains present in the nose often contaminate hands, fingers, faces, and nasal carriers which can easily become skin carriers [25]. Thus, the presence of *Staphylococcus* species on paper currencies could be due to rubbing off or maybe surfing from a skin flake [17].
Our study was supported by the fact that *staphylococcus* was recovered at a high frequency on notes sampled at meat shops (butcher houses) compared to those derived from the restaurant. The widely experienced attitude of applying saliva to fingers while counting the currency notes and squeezing birr all serve as potential routes of exposure to these bacteria. The prolonged stay of paper notes in circulation increases the chances for the notes to be more contaminated [26–27]. The type of contaminants on paper notes depends on the place and the activities performed before handling currency notes[28].

Regarding the prevalence of *Staphylococcus aureus*, 31.5% of the entire paper currency samples in the present study were positive for this bacterium. This study is in agreement with earlier reports [29] *S. aureus* 30.75%, 25% by [17] from Bangladesh, 28.7% by [30] from Iran, 27.3% by [31] from Nigeria, 25% by [4] from Ethiopia and *S. aureus* 38% by [19] showed that 4th version notes had mixed bacterial growth. However, this study was higher than (8.77%) reported from Pakistan by [32], [33] showed the isolated bacterial strains (7.14%). In view of the fact that *S. aureus* lives and flourishes in the human nose, throat and skin; the likelihood of frequent recontamination of paper currencies is quite high when good hygienic practices are not in place [34].

The current result of an 11.9% prevalence of *staphylococcus aureus* isolated from meat is lower than the report of 28% of *staphylococcus aureus* by [35] who isolated *Staphylococcus* from butcher shops in Mekele, Ethiopia. Moreover, [36] reported a 19.8% prevalence from butcher houses. This disagreement between our work and previous studies might be due to the environmental condition that may favor the pathogen to develop. Our study in disagreement with Ahmad and a coworker from Egypt isolated a higher prevalence in beef abattoirs (55%), this accords with our result in that a higher prevalence of *staphylococcus* is observed in the butcher shops than in the abattoir because of the continuous contamination through the transportation process.

About greater than 60% of ETB were harboring *staphylococcus* and showed high contamination within and among studies variables (source of the sample, location) of the currency in the studied kebeles. Our observation during sample collections led to the prediction of poor hygiene or relatively lower cleaning and disinfection practices could be attributed to the higher prevalence in their areas. Poor general hygiene makes them a likely agent for various disease transmissions. Food handlers who have skin lesions, or sneezing or coughing, are major sources of contamination of table foods [37]. Any food that requires handling in preparation may therefore easily become contaminated. Infected wounds, lesions, and boils of food handlers may also be sources of contamination, as well as coughing and sneezing by individuals with respiratory infections [38]. lower cleaning exercise could be attributed to the higher prevalence in their areas. Besides, a paper currency can serve as an ideal breeding ground for microorganisms [39]. In Ethiopia, poor currency handling culture is widespread, and there is indiscriminate abuse of currency notes reported by [4].

Of all 30 *staphylococci* screened for antimicrobial susceptibility tests against four antimicrobial drugs. Antibiotic sensitivity test of the isolates revealed maximum resistance for penicillin G (50%) and all the isolates were susceptible to chloramphenicol (100%) this finding is in agreement with a previous study by
In our study, meat sample isolate and birr isolate was resistant to one or more antimicrobials. There is no isolate that was sensitive to all four selected antimicrobials. The resistance pattern of other antibiotics in (meat) are as follows: Penicillin G (50%), Gentamycin (8.3%), Chloramphenicol (0%) and Tetracycline (33.3%). This result showed similar to the study by [43]. But, the isolates showed high susceptibility to chloramphenicol and Tetracycline as reported earlier by [40]. However, antibiotic resistance development among the Staphylococcal isolates poses a problem of concern. Such a trend of resistance to antibiotics can be attributed to the random use of antibiotics and different treatment choices in farms of this region [41].

If fresh beef is handled, cut and prepared in a hygienic environment during the distribution chain in the trading market, it will reduce the chance of contamination by staphylococcus which may lead to reduced possible food-associated diseases. Moreover, the emergence of methicillin resistance staphylococcus strains poses a great challenge in terms of effective treatment of the infections caused by these strains [44].

**Conclusion And Recommendations**

Our study reveals the fact that raw meat from a butcher’s house had a higher prevalence than that from a restaurant. This could be a result of sanitation measures taken as well as cleaning experience in restaurants. Paper currency notes is a significant vehicle for pathogenic staphylococcus bacteria. The ETB in circulation was found to be contaminated with staphylococcus as the prevalence recorded was higher in ETB than in raw meat. The result indicated the presence of cross-contamination between meat and paper currency notes as similar species of staphylococcus were found in both samples. It is imperative that basic hygienic practices be incorporated in restaurants and butcher houses to ensure food safety. Moreover, dealing with paper money deserves special attention. Antibiogram results showed all isolates of Staphylococcus were sensitive to chloramphenicol. However, most staphylococcus isolates were resistant to penicillin G. The emergence of methicillin resistance staphylococcus strains poses a great challenge in terms of effective treatment of the infections caused by these strains. The presence of staphylococcus in sample type and source of samples indicated its widespread and ubiquitous nature. Thus:

- The butcher men should not contact money at the services delivering center instead cashiers should collect money or change the usage of paper currency to credit cards.
- The butcher man uses a polythene bag (plastic) during handling meat, after handling currency notes and avoids the use of saliva during counting currency notes.
- Awareness creation for butcher houses, restaurants and abattoir workers about the contamination and cross-contamination of paper currency and meat in the food chain.
- The Government and stakeholders should ensure strict compliance with policies and procedures that will provide safe and high-quality meat for consumers and ensure proper hygienic slaughtering, transportation and handling practices of the meat.
• Training should be given to restaurant meat sellers and butchers regarding food safety practices and proper inspection procedures to minimize the contamination of raw meat and meat products sold in butcher houses and restaurants.
• Improvement of personal hygiene in butcher houses cutting tables, knives, and material used by the butcher to reduce the extent of contaminated meat and paper notes.

**Abbreviations**

BPW; Buffered peptone water

ETB: Ethiopian birr

I: intermediate;

No: Number

R; resistant

S. staphylococcus

S; sensitive;

**Declarations**

**Ethics approval and consent to participate**

Ethics approval and consent to services delivering centers and permission to conduct the research were approved by the Jimma University college of agriculture and veterinary medicine research ethical issues approval committee. For conducting this research, the researcher was requested and received a support letter from the university.

**Consent for publication:**

Not applicable.

**Availability of data and materials**

The data used to support the findings of this study are included in the article.

**Competing interests:**

The authors declare that they have no competing interest

**Funding**
No funding was gained for this research except for laboratory reagents and material support.

Authors’ contribution

SW and TK Conceived the study. SW; participated in sample collection and laboratory analysis. TK; Supervised sample collection and laboratory activities. SW and TK: Result writing and manuscript draft preparations. TK; data analysis, result writing and manuscript preparation. Both authors have read and agreed to the published version of the manuscript.

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