Microbiological Quality of Street Vended Foods in Hawassa City, South Ethiopia

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Outline

- Introduction
- Objectives
- Methodology
- Result and discussion
- Conclusion and Recommendation
- Acknowledgements
Introduction

- Street foods: ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers, especially in streets and other similar public places. (FAO, 1989)

- It feeds millions of people daily and relatively cheap and easily accessible. (Tambekar et al., 2008).

- Street foods displayed on open work area can easily be contaminated. (Tambekar et al., 2009)

- Main causes of contamination of SVF:
  - the traditional food preparation methods;
  - inappropriate holding temperatures;
  - poor personal hygiene. (Tambekar et al., 2008, Nicolas et al., 2007).
These foods are frequently associated with diarrheal diseases due to:

- improper use of additives,
- the presence of pathogenic bacteria,
- environmental contaminants and
disregard of good hygienic practices.

(Muyanja et al., 2011, Mensah et al., 2002)

Potential health risks are associated with contamination of food by potential pathogenic bacteria during preparation, post cooking and other handling stages.

(Ghosh et al., 2007)
Each year, millions of people worldwide suffer from food-borne diseases. (Abdalla et al., 2008)

In 2005 alone 1.8 million people died from diarrhoeal diseases. (National Codex Committee, 2010)

FBI of microbial origin is a major international health problem associated to food safety. (WHO, 2002)
FBI associated with the consumption of street foods has been reported in several places. (Ghosh et al., 2007, Chumber et al., 2007, Estrada-Garcia et al., 2004).

In Ethiopia, health risks associated with street foods are common. *Salmonella*, *Shigella* and other food-borne pathogens were isolated from different street foods. (Muleta and Ashenafi, 2001a, Ejeta et al., 2004, Alemayehu et al., 2002).
Objectives

General objective
• To determine the microbiological quality of street foods at Hawassa city, South Ethiopia from May to September 2014.

Specific objectives
• To determine total bacterial count in street foods.
• To identify pathogenic bacteria in street foods.
Methodology

1. **Study area and period**
   - The study was conducted at Hawassa city from May to September 2014

2. **Study design**
   - A community based cross sectional study design was undertaken

3. **Source population**
   - All street food items vended in five regularly vending areas at Hawassa city was source population.

4. **Study population**
   - Randomly selected six street food types which vended in five regularly vending areas.
5. Sample size and Sampling technique

- A simple random sampling technique was used to take samples from: Amora Gedl, Bus station, Piazza, Kochi and Gebeya dar.

- 72 participants were selected randomly from the registered vendors.

- For those vendors who had more than one food item, only one food type was picked by lottery method.
6. Inclusion and Exclusion criteria

**Inclusion criteria**
- Ready to eat foods namely: Ambasha, Kita, raw Fish, Awaze, Avocado and cooked Potato.

**Exclusion criteria**
- Any kind of fruits except processed avocado as salad form;
- All packed food items.
Method...

7. Study Variables
   • Dependent variables
     • Microbial quality
   • Independent variables
     • Socio-demographic characteristics
     • Hygienic practice
     • Knowledge of food preparation
     • Food handling
     • Knowledge of food contamination
Method...

8. Data Collection

8.1. Questionnaire and observation checklist
   • A pre-tested questionnaire and observation checklist were used

8.2. Laboratory methods
   • Standard microbiological techniques were used
Fig. 1: Pictures taken during data collection
8.2. Laboratory methods

1. Sample collection and transport
   • Samples were collected and then transported to the Microbiology laboratory in an ice box.

2. Sample processing
   • Ten grams of the food sample was homogenized in 90ml of 0.1% BPW;
   • Further dilution was made by adding 1ml of homogenate into 9ml of BPW
   • Serial dilutions of $10^{-2}$ and up to $10^{-5}$ were also made before transferring samples to the plates.
Method...

Street Food sample

Preparing Homogenized solution with 0.1% BPW of 1:10 dilution and serial dilution up to $10^{-5}$

Inoculate on Nutrient Agar, EMB Agar and MacConkey Agar by pour method

Incubate at 30-35°C for 24-48hrs

Fig. 2: Flow chart for Sample processing and colony counting

Colony count
Method...

Homogenized sample
Inoculate primary media & incubate at 37°C for 24hrs
Colony characteristics and Gram’s staining
Sub-culturing suspected colonies on NB
Biochemical tests
Isolation and identification

Fig. 3: Flow chart for Sample processing, isolation and identification of pathogenic organisms.
Method...

Fig. 4: Pictures taken during laboratory investigation.
Method...

9. Quality Control

- Standard operational procedures.
- Structured questionnaire and observation checklist pretested.
- The sterility of media was checked by incubating at 37°C.
10. Data Analysis

- Data was entered and cleansed into SPSS version 20.0
- Descriptive statistics were done.
- Results were summarized and presented by tables.
11. Ethical Consideration

- The research was ethically cleared by JU.
- Letter of cooperation was obtained from college and department.
- Permission was guaranteed from Hawassa University and SNNP Regional Health Bureau.
- Letter of support was also written from Hawassa town Health department.
- The vendors were informed and signed the consent form.
Result and Discussions
### Table 1. Socio-demographic characteristics of study participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency No(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>≤20</td>
<td>22(30)</td>
</tr>
<tr>
<td>21-30</td>
<td>30(42)</td>
</tr>
<tr>
<td>31-40</td>
<td>15(21)</td>
</tr>
<tr>
<td>≥41</td>
<td>5(7)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>13(18)</td>
</tr>
<tr>
<td>Female</td>
<td>59(82)</td>
</tr>
<tr>
<td><strong>Educational status</strong></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>9(12.5)</td>
</tr>
<tr>
<td>Primary Level</td>
<td>52(72)</td>
</tr>
<tr>
<td>Secondary Level</td>
<td>9(12.5)</td>
</tr>
<tr>
<td>College and above</td>
<td>2(3)</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>39(54.2)</td>
</tr>
<tr>
<td>Single</td>
<td>32(44.4)</td>
</tr>
<tr>
<td>Divorced</td>
<td>1(1.4)</td>
</tr>
<tr>
<td><strong>Length of time spent vending</strong></td>
<td></td>
</tr>
<tr>
<td>≤5 years</td>
<td>51(70)</td>
</tr>
<tr>
<td>6-10 years</td>
<td>10(14)</td>
</tr>
</tbody>
</table>
Result...

1. Socio-demographic characteristics of study participants

- The age of the study participant food vendors was ranged from 12 to 60 years having mean age of 27 year.
- More than 70% of them were below 30 years of age.
- Majority 59/72 (82%) of participants were females.

- Women are involved in a wide variety of food-processing activities because food preparation is the responsibility of them (Mensah et al., 2002).
Result...

- All participants were working at stationary.
- None of them took formal training on food preparation and safety.
- All of the vendors who participated in this study acquired food preparing skills from observation.
2. Hygienic practice of study participants

- 97% of the vendors had no habit of washing hands after handling money.

- However, majorities (81%) of the vendors were washing hands after using toilets and just before food preparation (74%).

- About 54% of the respondents did not use any detergents to wash.
Result...

Based on observation:

• 82% of the vendors did not use proper hair covering and worn gown.
• Nearly, 89% of them did handle food with their bare hands.
• 51% of the vendors were not covering the foods they had for sell
• In addition, 68% of the area around food vending or preparing had open and bad smelling drainage system.
• The water for washing and rinsing the utensils was observed dirty.
Fig. 5: Pictures show the street food vending area, food preparation practices and utensils.
Result...

3. Food contamination knowledge of the vendors

- About 79% of the vendors knew that microorganisms can contaminate foods;
- Only 44% of food vendors were familiar with the term "food-borne illnesses".
### Table 2. Mean colony count of food items

<table>
<thead>
<tr>
<th>Food items</th>
<th>Mean of TAC</th>
<th>Mean of Enterobacteriaceae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kita</td>
<td>$6 \times 10^5$</td>
<td>$2.3 \times 10^4$</td>
</tr>
<tr>
<td>Ambasha</td>
<td>$3 \times 10^5$</td>
<td>$1.1 \times 10^4$</td>
</tr>
<tr>
<td>Raw fish</td>
<td>$6.7 \times 10^6$</td>
<td>$6.8 \times 10^4$</td>
</tr>
<tr>
<td>Potato</td>
<td>$4 \times 10^5$</td>
<td>$2.5 \times 10^4$</td>
</tr>
<tr>
<td>Awaze</td>
<td>$1.7 \times 10^5$</td>
<td>$9.4 \times 10^3$</td>
</tr>
<tr>
<td>Avocado</td>
<td>$2.8 \times 10^5$</td>
<td>$1.7 \times 10^4$</td>
</tr>
</tbody>
</table>
### Table 3. Mean colony count of food items in respect to vending location

<table>
<thead>
<tr>
<th>Vending Location</th>
<th>Mean of TAC</th>
<th>Mean of Enterobacteriaceae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus station</td>
<td>3.8x10^4</td>
<td>2.1x10^3</td>
</tr>
<tr>
<td>Piazza</td>
<td>6.2x10^4</td>
<td>5.6x10^1</td>
</tr>
<tr>
<td>Gebeya dar</td>
<td>1.6x10^6</td>
<td>1.1x10^5</td>
</tr>
<tr>
<td>Amora gedl</td>
<td>2.7x10^6</td>
<td>1.2x10^5</td>
</tr>
<tr>
<td>Kochi</td>
<td>8.3x10^4</td>
<td>1.5x10^3</td>
</tr>
</tbody>
</table>
4. Colony count
- Total aerobic count (TAC) of food samples varied from $1.7 \times 10^5$ to $6.7 \times 10^6$ CFU/g (mean $5.4 \times 10^5$ CFU/g).

- Unhygienic handling and serving practices,
- Improper cleaning of dishes;
- Contaminated hands of vendors;
- Differences in methods of preparation;
- Type of foods;
- Use of raw materials with different levels of contamination;
- Perhaps lack of knowledge of hygienic practices and safety of food products.

Similar mean TAC ($5.9 \times 10^5$ CFU/g) Kumasi, Ghana (Feglo and Sakyi, 2012).
The value of *Enterobacteriaceae* count was between $8.2 \times 10^3$ and $6.8 \times 10^4$ CFU/g.

- Higher than $(<10$ to $4.7 \times 10^4)$ report made in Accra, Ghana (Mensah et al., 2002)
- $(6 \times 10$ to $8 \times 10^2$) in Ismailia, Egypt (Ismalia, 2006)

Lower than $>10^5$ CFU/g reported in Addis Ababa (Muleta and Ashenafi, 2001a).

- improper handling
- poor hygienic conditions present in the vending vicinity.
Result...

31% of street foods showed higher total aerobic count when compared with the acceptable reference values.

Variation
- differences in food items,
- food contents,
- environment,
- personal hygiene,
- unhygienic food processing practices
- prolong exposure of the foods to the different environmental conditions.
5. Bacterial isolates

- A total of 71 bacterial isolates made up eleven genera were detected.
- The highest rate from raw fish (24%) followed by Potato (18%) and Awaze (15%).
- The highest rate of *E. coli* (23.8%) in ‘Avocado’, *S. aureus* (42.8%) in ‘Awaze’ and *Salmonella Spp.* (78%) in ‘Raw fish’.
- In respect to vending areas *Salmonella Spp.* (78%) and *E. coli* (38%) from ‘Amora gedel’
- The highest rate of *S. aureus* was recorded at Kochi (42.8%).
Result...

- *E. coli* was the most frequent isolate (29.6%).

- Salmonella species (12.7%).

- 57.5% of *E. coli* documented in Bahir Dar (Kibret and Tadesse, 2013).

- No *E. coli* in similar study in Ethiopian, 2010.

Differences may be due to
- in clothing, hygienic cleaning, handling and serving practice of vendors as it was indicated by Fang et al. (Fang et al., 2003).
Result...

- Similar type of bacterial isolates had been also obtained
- Macaroni and “Bonbolino” in Gondar (Derbew et al., 2013),
- Street meat in Mekele (Haileselassie et al., 2013),
- Red pepper, macaroni and other traditional foods in Ghana (Feglo and Sakyi, 2012),
- Rice, beans, fish, salad and other food items in Nigeria (Akinvemo et al., 2012).

The presence of members of bacteria in the family Enterobacteriaceae usually seen as a major health risk to microbial safety of the food (Oluyege et al., 2009).
• 56.2%, Benin (Sina et al., 2011),
• 51.8%, Gondar (Derbew et al., 2013),
• 39.1%, Ghana (Mensah et al., 2002),
• 17.9% Thailand (Fang et al., 2003),
• 3.2% South Africa (Nyenje et al., 2012).

The prevalence of *S. aureus* in the food samples examined in this study was 10%.

- Due to
  - improper personal hygiene
  - contaminated hands of vendors
  - indicating lack of knowledge of hygienic practices and safety of food products (Tambekar et al., 2009).
Conclusion and Recommendation
Conclusion

This study has demonstrated that street vended foods that are sold on the streets of Hawassa are highly contaminated.

- Lack of training (orientation) on the proper handling and processing of food;

- poor personal hygiene of vendors;

- unhygienic surroundings could be possible factors for observed problems in that locality.
Conclusion...

- High rate of potential enteric pathogens indicating that raw fish and potato are more likely risk for causing foodborne illness;

- Samples from ‘Amora gedel’ were more contaminated with *Salmonella Spp* and *E. coli* than other vending areas;

- Potential pathogenic bacteria in our study are evident that street foods might contribute a major problem for public health.
• Public health authorities and the vendors themselves should make efforts to monitor conditions of sanitation and hygiene in establishments;

• The regional Health bureau and Hawassa Town Health administration ought to create awareness.
Recommendation...

- Regular inspection on food vending practices need to be made.

- Lastly, further study on large scale sample size is recommended to produce much more relevant information about microbial status of street vended foods in that locality.
Acknowledgement

- Heartfelt gratitude to my Advisors, Mr. Gebre Kibru, Mrs. Haimanot Tasew and Mr. Derese Daka.

- Jimma University, for the financial support.

- SNNPR Regional Laboratory branch Microbiology Unit and Hawassa University referral Hospital Microbiology Laboratory.

- Finally, Glory and thanks for Almighty God.
Thank You