Assessment of the Effectiveness of Food Safety Management Systems in Beef Abattoirs in Lusaka District, Zambia

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Background

Food safety management systems are central to controlling microbial hazards in abattoirs, yet their effectiveness depends on consistent implementation beyond documented procedures[1,2].

In Zambia, persistent foodborne risks suggest that FSMS performance in beef abattoirs remains inadequately characterised[3].

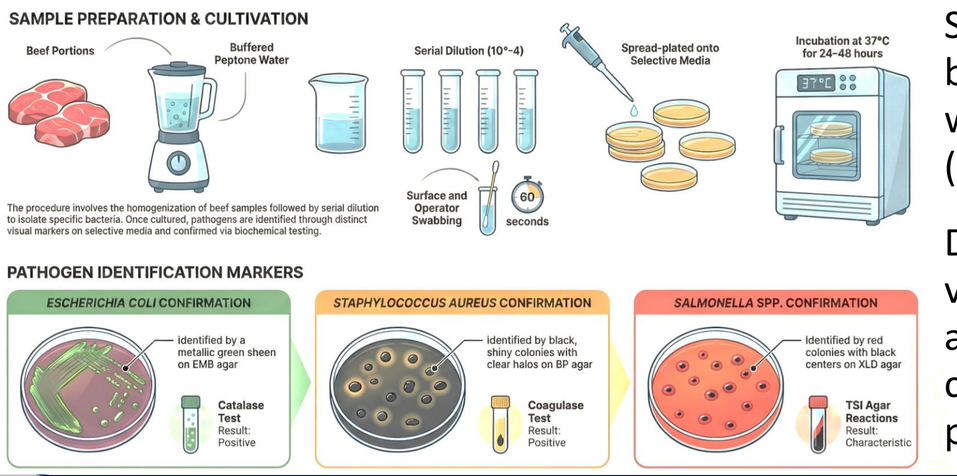
This study sought to assess the effectiveness of FSMS in beef abattoirs of Lusaka.

Materials & Methods

A cross-sectional descriptive study was conducted in three consenting beef abattoirs in Lusaka district.

The Food Safety Management System Diagnostic Instrument was used to evaluate core control and assurance activities, while the Microbial Assessment Scheme assessed microbiological performance[2,4].

Fifty samples were collected across five critical sampling locations including carcasses at key processing stages (32), operators' hands (9), and knives (9).



Selective culture media and biochemical confirmation were used for the samples (Fig 1).

Data were analysed in SPSS version 28 using descriptive and inferential statistics to compare contamination patterns across abattoirs.

Results

Table 1:Types of FSMS implemented across the assessed beef abattoirs

Type of Food Safety Management Systems	Food Safety Management Systems Implemented		
	Abattoir A	Abattoir B	Abattoir C
Good Manufacturing Practices (GMPs)			
Good Hygiene Practices (GHPs)			
Sanitation Standard Operating Procedures (SSOPs)			
Hazard Analysis and Critical Control Points (HACCP)			

Key

Implemented	
Not Implemented	

Table 2: Depicts the Performance of FSMS components in Each Beef Abattoir

Abattoir	Core Control FSMS Activities	Core Assurance Activities	Food Safety Performance Indicator	Performance Category
A	1.08	1.33	0.67	Basic
B	2.40	2.00	2.00	Average
C	2.12	2.00	2.00	Average

Note: mean scores were evaluated on a 0-3 scale, where 0 = Absent/Low, 1 = Basic, 2 = Average, and 3 = Advanced. Therefore, the interpretation of mean scores followed these predetermined thresholds in line with the scale: 0-0.2 = absent/low, 0.3-1.2 = basic, 1.3-1.7 = basic to average, 1.8-2.2 = average,2.3-2.7 = average to advanced, and 2.8-3.0 = advanced

Microbiological analysis detected *Staphylococcus* spp. (70%) and *Escherichia coli* (54%) as the most prevalent organisms, particularly at CSLs involving operator hands and knives.

Klebsiella spp. (22%), *Streptococcus* spp. (24%), and *Shigella* spp. (6%) were also detected, while *Salmonella* spp. was not isolated. Significant differences in contamination were observed for *E. coli* and *Klebsiella* spp. across abattoirs ($p < 0.05$).

Table 3: Depicts the summary of Microbiological Safety Level Profile Across the Beef Abattoirs

Abattoir	Total Score	Performance Category
A	4	Poor (1)
B	10	Moderate (2)
C	7	Poor-Moderate (1-2)

Note: The maximum possible total score per abattoir was 15. Performance was interpreted as follows:

- *3 - 6: Poor (score 1),*
- *7 - 8: Poor to Moderate (score 1-2)*
- *9 - 10: Moderate (score 2)*
- *11 - 13: Moderate to Good (score 2-3)*
- *14 - 15: Good (score 3)*

Conclusion

Despite the presence of foundational FSMS elements, inconsistent implementation particularly at critical sampling locations, highlights the need for strengthened HACCP adoption, targeted hygiene control, and enhanced regulatory oversight to improve beef safety in Lusaka.

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