European Journal of Agriculture and Food Sciences
Vol 6 | Issue 4 | July 2024
ISSN 2684-1827

RESEARCH ARTICLE

Short Communication: Microbiological Quality of Food Purchased from Home-Based Dark Kitchens

Chitika Chakshu Pudaruth[1] and Susheela Devi Biranjia-Hurdoyal[1,2,*]

ABSTRACT

Purchase of locally processed food from home-based dark kitchens is common in Mauritius. This study aimed to compare the microbiological quality of locally processed food purchased from HACCP (hazard analysis critical control point) certified suppliers and non-HACCP certified foods purchased from home-based dark kitchens. A total of 16 food samples were collected and processed. Bacterial growth was observed in 87.5% of the non-HACCP samples and 25% of HACCP samples. The colony forming units were significantly higher in non-HACCP samples compared to HACCP samples (p = 0.04). *E. coli* was isolated from 25% and 37.5% of HACCP and non-HACCP food samples, respectively. It was noted that 64.3% of the bacteria isolated were resistant to amoxicillin, and 100% of the Pseudomonas spp. was resistant to ampicillin (10 µg), chloramphenicol (30 µg), and tetracycline (10 µg). There is a need to educate the population on food safety and the risks associated with the purchase of food from unregulated suppliers.

Keywords: Food quality, Food safety, HACCP, Home-based dark kitchen.

Submitted: April 15, 2024

Published: July 17, 2024

10.24018/ejfood.2024.6.4.803

[1] *Department of Health Sciences, Faculty of Medicine & Health Sciences, University of Mauritius, Mauritius.*
[2] *Member of Pole of Research Excellence-Molecular Life Sciences, University of Mauritius, Mauritius.*

* ***Corresponding Author:***
Email: s.biranjia@uom.ac.mu

1. Introduction

Foodborne diseases originating from households should not be neglected [1]. Developing countries suffer from higher prevalence of foodborne illnesses because of lower living conditions and sanitation facilities [2]. Since the Covid-19 pandemic, an increase in online sales of foods has been noted. Dark kitchen operates without premises for consumption and has no direct contact with its consumers. The sale occurs exclusively online, and the cost is cheaper than in a traditional restaurant. The dark kitchens prosper based on word of mouth and support from the community [3], [4].

In Mauritius, social platforms such as TikTok and Facebook have been used for the flourishing business of dark kitchens. Delivery is done at the client's home or a neutral place such as shopping malls, bus stations and taxi stand. These suppliers remain unknown to the health authorities and, hence, unchecked. The quality of the foods also remains unknown. This study aimed to compare the microbial quality of food purchased from dark kitchens (non-HACCP) and foods which are HACCP certified.

2. Materials and Methods

This study was carried out to investigate the microbiological quality of locally produced processed food products. A total of 16 locally produced local food samples were collected and categorised as being HACCP certified and non- HACCP certified. The samples included local foods such as farata, dhollpuri, chicken saomai, veg saomai, boulette chou-chou, fish boulette, chicken samoussa and veg samousa. The HACCP-certified foods were purchased from supermarkets, while the non-HACCP samples were purchased from home-based dark kitchens. The samples were brought to the laboratory for microbiological analysis on the same day; after being crushed by a sterile mortar and pestle, 10 g of food was aseptically transferred into 90 ml of sterile peptone water. A serial dilution of the original suspension was carried out till the dilution factor had reached 10^{-6}. Total viable bacterial count was performed. Isolation and confirmation were also carried out for *Escherichia coli, Salmonella* species, *Pseudomonas* species, and *Staphylococcus aureus*. Total viable bacterial count was done by spread-plate method, whereby 0.1 ml of the diluted sample was transferred onto

TABLE I: Colony Forming Units for Haccp and Non-Haccp Samples

Samples	HACCP	Non-HACCP
Average CFU/g	2.5×10^2	9.6×10^4

TABLE II: Antibiotic Susceptibility Testing Results

Isolate	Sample	Amp (10 µg)	C (30 µg)	T (10 µg)
E. coli	Sample 1	R	I	S
	Sample 2	R	I	S
	Sample 3	R	I	S
	Sample 4	I	S	R
	Sample 5	I	I	R
Salmonella	Sample 1	R	I	S
	Sample 2	R	S	S
Pseudomonas	Sample 1	R	R	R
	Sample 2	R	R	R
	Sample 3	R	R	R
	Sample 4	R	R	R

Note: All readings were done as per CLSI. R–Resistant; I–Intermediate; S–Sensitive; Amp–Ampicillin; C–Chloramphenicol and T–Tetracycline.

freshly prepared sterile nutrient agar plates. The samples were then uniformly spread using a sterile glass spreader. All the culture plates were then incubated for 18–24 h at 37 °C. The samples were also streaked on Mac Conkey agar, Salmonella-Shigella Agar, Cetrimide agar, and Salt mannitol agar. The total viable bacterial count was read as the mean number of colony forming units (CFU). The results for the bacterial identification for each bacterium (*E. coli, Salmonella, Pseudomonas* species and *S. aureus*) for both HACCP and non-HACCP samples were recorded as per being absent or present in each sample. Antibiotic susceptibility test was also performed and interpreted as per the guidelines of the Clinical and Laboratory Standard Institute (2018). Ampicillin (10 µg), chloramphenicol (30 µg), and tetracycline (10 µg) were tested by Kirby Bauer method. The data analysis was done via the IBM Statistical Package for Social Science (SPSS v. 21.0).

3. Results

It was noted that 7 out of 8 non-HACCP samples (87.5%) had bacterial growth, while 2 out of 8 HACCP samples (25%) had bacterial growth. The CFU was higher from non-HACCP samples compared to HACCP samples (Table I).

The difference in colony forming units for HACCP and non-HACCP samples was statistically significant ($p = 0.04$). *E. coli* was isolated from 25% and 37.5% of HACCP and non-HACCP food samples, respectively. *Salmonella* spp. was found in one HACCP and one non-HACCP food sample. However, *Pseudomonas spp*. was isolated from 50% of HACCP samples and *S. aureus* from 37.5% of non-HACCP samples. The non-HACCP and HACCP samples of chicken samousa, which showed positive growth in Salmonella, were subjected to high temperature and fried. The samples were processed again, and both turned negative for Salmonella. Antibiotic sensitivity test was done for the isolates (Table II).

Pseudomonas spp. showed resistance to the three antibiotics tested. All the gram negatives were either resistant or showed intermediate results to Ampicillin.

4. Discussion

This study aimed to compare bacterial counts from HACCP certified and non-certified food products. As expected, the count was significantly higher from the non-HACCP foods. The isolation of *E. coli* from both HACCP and non-HACCP food products indicates lack of hygienic practices. There should be strict control at the food production premises and strict control of the sale of food products. The bacterial count and presence of *E. coli* from HACCP samples could be due to a lack of proper handling during packaging.

S. aureus colonization and infection occur at a high rate in the community [5]. The presence of *S. aureus* from the non-HACCP food indicated possible cross-contamination of the normal flora during food preparation. The food samples which were positive for Salmonella were further cooked, and it was noted that the high temperature killed the bacteria. It should be noted some of the locally produced foods are stir fried, some are microwave-heated, and others are steamed. Therefore, the risk of microbial survival will depend on the processing of the food after purchase.

For the *Pseudomonas spp*., antibiotic resistance was observed for 100% of the isolates. *Pseudomonas* spp. has been isolated from various sources such as food, soil, water, and food processing environments [6], [7]. The bacteria have been recognized as major food spoilers and display resistance to various antibiotics from different classes [6]. The emergence of multidrug-resistant Pseudomonas remains a concern at the hospital level [8], and the role of food in the spread of antimicrobial resistant genes to humans has also been investigated [9].

In this study, 81.8% of the gram-negative bacteria were resistant to amoxicillin. A point prevalence survey on antibiotic use in the hospitals of Mauritius reported that 50% of patients who were treated with antibiotics were those with community-acquired infections. Furthermore, amoxicillin accounted for more than 75% of the prescriptions [10].

5. Conclusion

The presence of *E. coli* indicated the lack of hygienic conditions prevailing during food production. Regulatory agencies should enforce standards and inspections to ensure compliance with food safety regulations and protect public health.

Limitation

The sample size was small. Future studies should focus on larger samples from unregulated suppliers such as street vendors, dark kitchens, and local markets.

Funding

The University of Mauritius funded the experimental work as part of an undergraduate project.

Ethical Clearance

Not required.

Conflict of interest

The authors declare that they do not have any conflict of interest.

References

[1] Finger JAFF, Baroni WSGV, Maffei D, Bastos DHM, Pinto UM. Overview of foodborne disease outbreaks in Brazil from 2000 to 2018. *Foods*. 2019;8(10):434. doi: 10.3390/foods8100434.

[2] Odeyemi OA, Sani NA, Obadina AO, Saba CKS, Bamidele FA, Abughoush M, *et al.* Food safety knowledge, attitudes and practices among consumers in developing countries: an international survey. *Food Res Intern*. 2019;116:1386–90. doi: 10.1016/j.foodres.2018.10.030.

[3] Sharma JK, Kumar N. Service quality, satisfaction and behavioural intention: mediation and interaction analysis in eletronic food ordering services. *Acad Mark Stud J*. 2019;23(3):1–15.

[4] Hakim MP, Zanetta LD, da Cunha DT. Should I stay, or should I go? Consumers' perceived risk and intention to visit restaurants during the COVID-19 pandemic in Brazil. *Food Res Intern*. 2021;41:110152. doi: 10.1016/j.foodres.2021.110152.

[5] Knox J, Uhlemann AC, Miller M, Hafer C, Vasquez G, Vavagiakis P, *et al.* Environmental contamination as a risk factor for intra-household staphylococcus aureus transmission. *PLoS One*. 2012;7(11):e49900. doi: 10.1371/journal.pone.0049900.

[6] Thomassen GMB, Reiche T, Tennfjord CE, Mehli L. Antibiotic resistance properties among pseudomonas spp. Associated with salmon processing environments. *Microorganisms*. 2022;10(7):1420. doi: 10.3390/microorganisms10071420.

[7] Meng L, Liu H, Lan T, Dong L, Hu H, Zhao S, *et al.* Antibiotic resistance patterns of Pseudomonas spp. Isolated from raw milk revealed by whole genome sequencing. *Front Microbiol Sec Antimicrobials, Resistance Chemother*. 2020;1. doi: 10.3389/fmicb.2020.01005.

[8] Nuckchady DC. Antibiotic usage pattern in a hospital in Mauritius, the rata score and its association with multi-drug resistance. *World J Pharm Pharm Sci*. 2022;12(2):19–31.

[9] Decimo M, Silvetti T, Brasca M. Antibiotic resistance patterns of Gram-negative psychrotrophic bacteria from bulk tank milk. *J Food Sci*. 2016;81:M944–M951. doi: 10.1111/1750-3841.13250.

[10] Veerapa-Mangroo LP, Rasamoelina-Andriamanivo H, Issack MI, Cardinale C. Point prevalence survey on antibiotic use in the hospitals of Mauritius. *Front Antibiot Sec Antibiotic Resistance*. 2023;1:2022. doi: 10.3389/frabi.2022.1045081.