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2 ND INTERNATIONAL SCIENCE, ENGINEERING AND TECHNOLOGY COLLOQUIUM



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PREFACE

Welcome to the 2nd International Science, Engineering and Technology Colloquium 2025 (ISETC 2025)!

It is with great pleasure that we present this year's colloquium, a distinguished gathering of scholars, researchers, and professionals dedicated to the advancement of applied sciences. Held virtually on 9th July 2025, ISETC 2025 serves as a platform to highlight cutting-edge research, foster meaningful networking, encourage collaborations, and explore innovative solutions to global challenges.

This year's theme, "The Power of Scientific Innovation: Intelligent Solutions for a Sustainable World" highlights our shared goal to solve global challenges through applied science. It celebrates innovation as a key to building a more sustainable and resilient future. We're proud to feature keynote speakers and presenters who bring fresh insights, bold ideas, and breakthroughs shaping tomorrow's world.

We would like to extend our heartfelt appreciation to the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, for their outstanding support and assistance throughout the planning and execution of the event. Their dedication has been instrumental to the success of this colloquium. We would like to sincerely thank all participants and researchers for their valuable contributions. We also appreciate the reviewers for their careful evaluations and helpful feedback. Your hard work and support mean a lot to us.

As editors, we are proud to present this collection of proceedings. It is an honour to bring together the interesting and meaningful work of our speakers and authors. We hope the ideas shared will lead to new discoveries, encourage more research, and help solve global challenges through science and innovation.

Warm regards,

Dr. Emi Norzehan Mohamad Mahbob
Dr. Saiyidah Nafisah Hashim
Ms. Lili Widarti Zainuddin
Ms. Nurul Nazwa Mohammad
Ms. Rozaina Saleh

ISETC 2025 Proceedings Editors

PRELIMINARY STUDY OF GRAM-STAINED BACTERIAL CONTAMINATION IN READY-TO-EAT FOODS FROM UNIVERSITY CAFES

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Abstract: Food safety is a critical aspect of public health, as foodborne diseases continue to pose global risks, ranging from gastrointestinal infections to fatal outcomes. Ready-to-eat (RTE) foods are commonly consumed by university students due to its widespread availability and convenience. However, students often store these foods for later consumption, especially in dormitories, a practice that may increase the risk of contamination, particularly in Malaysia's warm and humid climate. The aim of this study is to assess bacterial contamination in RTE foods following typical student storage practices. Food samples were collected from two cafes at a local university in Malaysia and divided into two groups: one group was immediately swabbed after purchase, while the other group was stored at room temperature for 24 hours in either plastic bags or sealed containers. After storage, bacterial cultures were grown and analyzed using Gram staining. The results showed that one café, operating in an outdoor ambient environment, had a higher proportion of Gram-negative bacteria, which are commonly associated with food spoilage and illness. In contrast, the café located indoors with air-conditioning showed predominantly Gram-positive bacteria. These trends persisted after storage, suggesting initial contamination at the point of food handling strongly influences bacterial profiles, regardless packaging type. This study highlights the importance of basic food safety awareness on campus and encourages safer food handling and storage practices among students and vendors alike.

Keywords**:** *Ready-to-eat food, food safety, foodborne diseases, gram staining, campus cafeteria hygiene*

INTRODUCTION

Bacterial contamination of ready-to-eat (RTE) foods remains a persistent public health concern, particularly when these items are subjected to improper handling or stored at room temperature without refrigeration. Warm, humid environments provide ideal conditions for bacterial growth, increasing the risk of foodborne diseases (Bintsis, 2017). On university campuses, RTE foods are commonly consumed due to their convenience, and are often stored for later consumption, further emphasizing the need for proper food safety practices. This study investigates bacterial contamination in RTE food items obtained from two university cafes, comparing samples swabbed immediately after purchase and after 24-hour room temperature storage in different packaging types. Gram staining was employed as a rapid and conventional method to classify bacterial isolates into Gram-positive and Gram-negative groups. This preliminary analysis aims to provide insight into how food displays, storage duration and packaging influence microbial profiles, informing strategies to improve food hygiene and reduce contamination risk in campus environments.

LITERATURE REVIEW

According to World Health Organization (WHO, 2021), foodborne diseases refer to illnesses resulting from the ingestion of contaminated food, which can occur at any point along the production, handling, storage or consumption chain. These diseases encompass a wide range of conditions, ranging from gastrointestinal infections leading to diarrhoea to long-term health effects such as cancer. Globally, foodborne diseases represent a significant public health concern, affecting both developed and developing countries. Common bacterial pathogens associated with foodborne diseases include *Salmonella*, *Campylobacter* and *Escherichia coli*, alongside various viruses and parasites (Abdolshahi & Yancheshmeh, 2020; Ehuwa et al., 2021). Although foodborne diseases pose a serious public health risk, their true global burden is often underestimated, largely due to underreporting and the difficulty

of tracing sporadic cases to specific food sources. WHO (2024) estimated that approximately 600 million people (1 in 10 globally) fall ill each year from consuming contaminated food, with 420,000 deaths annually. These statistics highlight the critical importance of implementing effective food safety measures at national and local levels.

In the Malaysian context, foodborne outbreaks are frequently reported during festivals or in institutional settings such as schools and universities, where food is often prepared in large quantities and displayed for extended periods under suboptimal hygienic conditions (Aspian et al., 2024). Contributing factors include poor personal hygiene of food handlers, inadequate coverage of prepared foods and contamination of food-contact surfaces (Zulfakar et al., 2018). Furthermore, foodborne diseases are frequently underreported, particularly in small-scale outbreaks, where the source of contamination may remain unidentified. This underreporting reinforces the need for stricter food safety enforcement and monitoring. RTE foods are widely consumed by students at local university campuses in Malaysia due to their convenience, affordability and availability. Cafes on campus often serve the primary source of daily meals. In such environments, ensuring food hygiene is essential to safeguard students' health. The risk of bacterial growth is further heightened by Malaysia's warm and humid climate, particularly when RTE foods are stored at room temperature for extended periods (Hassan et al., 2023). This study focuses on evaluating the microbial safety of RTE foods sold at two high-traffic cafes within a local university in Malaysia, by comparing bacterial contamination immediately after purchase and following 24-hour room temperature storage using different packaging methods.

MATERIALS AND METHODS

The study was conducted at a local public university in Malaysia. Two campus cafes, referred to as Café A and Café B were selected as the sampling site. The test food item was *roti jala*, a local ready-to-eat delicacy that was available at both locations. Food samples were purchased fresh from each café and divided into two experimental groups: The "immediate swab" group and "24-hour storage" group. For "immediate swab" group, samples were transported directly to the laboratory and immediately swabbed for bacterial analysis. Swabs were streaked onto nutrient agar plates, which were then incubated at 37°C for 24 hours. For the "24-hour storage" group, food samples were stored at room temperature (approximately 25 - 28°C) for 24 hours in two types of packaging: plastic food bags and sealed plastic containers (commonly referred to as Tupperware). After the storage period, bacterial swabs were taken and cultured on nutrient agar under the same incubation conditions.

Following incubation, bacterial growth was visually assessed, and representative colonies were subjected to Gram staining. The stained samples were examined under a light microscope to determine bacterial cell morphology and classify isolates as Gram-positive or Gram-negative. The percentage distribution of Gram-positive and Gram-negative bacteria was calculated for each group. All experiments were conducted in N = 5 to ensure reproducibility.

RESULTS

Bacterial swab analysis of the immediate group revealed distinct Gram staining profiles between the two cafes. Samples from Café A exhibited a predominance of Gram-negative bacteria accounting of 99.00% ± 2.18 of the observed colonies. In contrast, samples from café B consisted entirely of Gram-positive bacteria. The bacteria populations from each café were thus almost exclusively composed of a single Gram type (figure 1A). Morphologically, the majority of Gram-negative bacteria from café A were cocci-shaped, which was similar to Gram-positive cocci morphology observed in café B (figure 2).

Following 24-hour storage at room temperature, a different trend was observed. In café A, both plastic-wrapped and container-stored samples showed a continuous dominance of Gram-negative bacteria. However, samples from Café B remained dominated by Gram-positive bacteria, with mean percentage of 96.72% ± 7.33 in plastic storage and 99.00% ± 2.24 in container storage (figure 1B). These findings suggest that the initial microbial load and origin of the food have a greater influence on the type of bacterial contamination than the type of packaging used during room temperature storage. In terms of bacterial morphology, café A samples stored for 24-hours displayed greater diversity, including both Gram-negative bacilli and Gram-positive cocci. In contrast, café B samples showed more uniform morphology: predominantly Gram-positive bacilli in plastic storage and Gram-positive cocci in container

storage (Figure 2). This represents a shift from the immediate swab group, where cocci were dominant, toward a higher presence of bacillus forms in the 24-hour storage group.

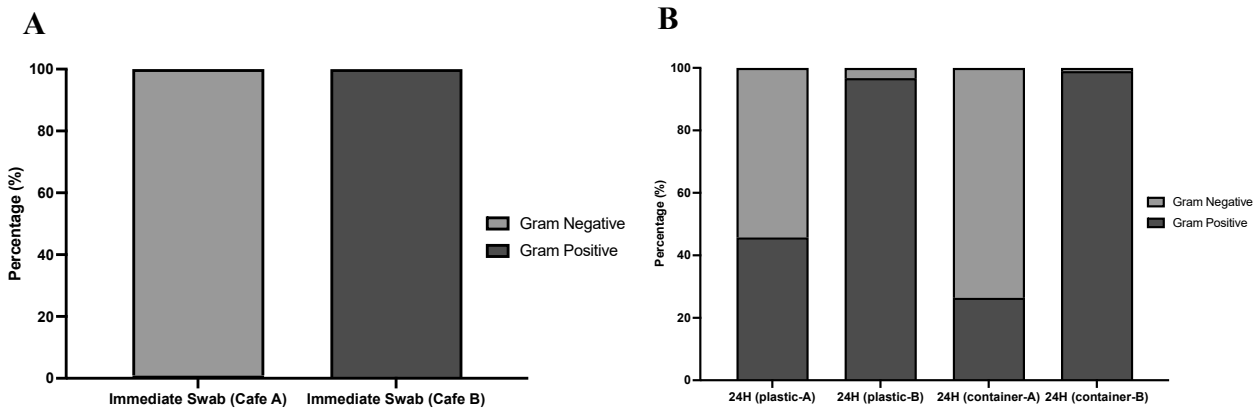


Figure 1. Bacteria swab analysis based on Gram staining on food sample from two cafes after A. Immediate swab; B. After 24-hour storage at room temperature. Bacteria population in food sample after immediate swab shows exclusively single type of Gram population compared to after the 24-hour storage. N = 5

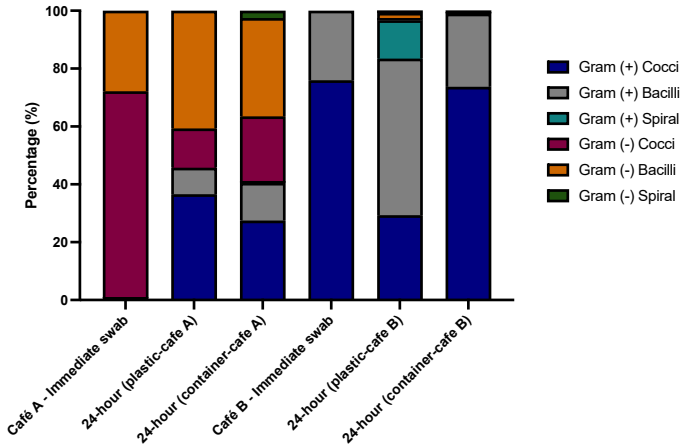


Figure 2. Bacteria swab analysis based on Gram staining and bacterial morphology on food sample from two cafes after immediate swab and after 24-hour storage at room temperature.

DISCUSSION/ANALYSIS

This study highlights distinct differences in bacterial contamination profiles of RTE foods from two cafes in a local university in Malaysia with differing environmental conditions. Café A, exposed to ambient temperature showed a high proportion of Gram-negative bacteria in fresh samples. In contrast, Café B, an air-conditioned indoor cafe, exhibited exclusively Gram-positive bacteria. These findings suggest that higher, ambient temperature is likely to promote the growth of Gram-negative bacteria which are often linked to food spoilage and potential pathogenicity (Madigan et al. 2018 and Bintsis, 2017). After 24-hour of room temperature storage, café A samples continued to show dominance of Gram-negative bacteria along with an increase in Gram-positive bacteria, indicating overall bacterial proliferation. Packaging type had minimal impact on bacterial type after 24-hour storage, highlighting the source of the food and its preparation environment as the more critical determinants of contamination risk. Morphological analysis supported these quantitative results where Gram-negative rod-shaped and spiral bacteria, which are often associated with spoilage and pathogenicity, were more prevalent in Cafe A. This is concerning since

this group includes many pathogenic species associated with foodborne illness (Bintsis, 2017). In contrast, cocci-shaped bacteria were more common in Cafe B and this suggests not only quantitative but also qualitative differences in microbial risks (Moi, et. al. 2022).

These findings underscore the need for better food safety practices and awareness. Vendors should maintain hygienic food preparation and food display, while consumers must be cautious with the food storage. Given Malaysia's hot and humid climate, combine with outdoor food handling, the risk of microbial proliferation in RTE food increased significantly when storage conditions are not controlled, emphasizing the importance of hygiene, environmental control and informed handling.

CONCLUSIONS

This study demonstrated that both the cafe environment and storage method influence bacterial contamination in RTE food sample stored at room temperature. Higher contamination, particularly with Gram-negative bacteria, was found in samples from the outdoor, ambience temperature café A, compared to café B which is located indoors and with air-conditioned. These findings emphasize the importance of hygienic food preparation and proper storage practices in minimizing microbial risks. Universities administrations are encouraged to strengthen food safety guidelines, conduct regular hygiene inspections and promote safe food handling among students.

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Sekian, terima kasih.

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Setuju.

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