

Survey situation of Coliform Contamination in Ready-to-Eat Foods from Night Market in Huahin District, Prachubkirikhan Province in Year 2023

Sutthida Techathummanan¹, Pattadon Klomsawat², Maytanin Klainin², Panisara Suvarnajutha³, Amonsak Traiatthasidthi⁴, Natnicha Charoenlarpdilok⁵, Pacharawich Wongwairattanakul⁶, Pariyakorn Pokcharaspreeda⁷, Chanognan Panyakiatikun⁸, Chaninat Panyakiatikun⁸

¹Montfort College, 19/1, Montfort Rd., Tha Sala, Muang Chiang Mai, Chiang Mai 50000 Thailand

²Triam UdomSuksa School, 227 Phayathai Road, Pathum Wan, Bangkok, Thailand

³Suankularb Wittayalai Nonthaburi School, 51 KaenRattana Rd, Tambon Pak Kret, Pak Kret District, Nonthaburi, Thailand

⁴Sentinel Secondary School, 1250 Chartwell Dr West Vancouver, BC 100000

⁵King Mongkut's International Demonstration School, 1 ThanonChalong Krung, Ladkrabang, Bangkok, TH 10520

⁶Princess Chulabhorn Science High School Nakhon Si Thammarat, 120, Nakhon Si Thammarat-PakPhanang Road, Bang Chak, Mueang Nakhon Si Thammarat District, Nakhon Si Thammarat 80330

⁷Mahidol University International Demonstration School, 999 Phuttamonthon Sai 4 Road Salaya, Phuttamonthon, Nakhon Pathom 73170, Thailand.

⁸Yothinburana School, 1313 Khwaeng Bang Sue, Khet Bang Sue, Krung ThepMaha Nakhon 10800

Corresponding Author E-mail:phattharawadee3989@gmail.com

Abstract:

"Street Food," also known as roadside food, is one of the options for dining due to the variety of menu choices and cost-effectiveness. However, street food poses challenges to health and hygiene due to the preparation and sale of food in temporary stalls. There might be health and hygiene risks associated with consuming street food, as there could be contamination in the food. The purpose of this study is to investigate the prevalence of contamination in food available for consumption at the popular night market, which is favored by tourists and the local community in the area.

The study was conducted by collecting samples of ready-to-eat food sold at three night markets in Hua Hin District, Prachuap Khiri Khan Province. The samples were gathered using a convenient sampling method. There were six categories of ready-to-eat food, including stir-fried dishes, deep-fried dishes, grilled dishes, salads, ready-to-eat rice dishes, and desserts. Each category had 10 samples, making a total of 60 samples from all three night markets. The sampling took place from 18:00 to 20:00 on July 15-17, 2023. The test focused on detecting coliform bacteria contamination in the ready-to-eat food, using coliform testing kits produced by the Pharmaceutical Organization, and the test results were interpreted within 24 hours after the testing was conducted.

The study results revealed that out of the collected food samples, 19 samples did not meet the standards, accounting for 31.67%. These non-compliant samples included 2 samples of stir-fried dishes, which accounts for 20%, 3 samples of grilled dishes, accounting for 30.00%, 10 samples of salads, accounting for 100.00%, 3 samples of ready-to-eat rice dishes, accounting for 30.00%, and 1 sample of desserts, accounting for 10.00%. On the other hand, 41 samples passed the standards, accounting for 68.33%. If choosing to buy street food, consumers should opt for freshly cooked food specifically to minimize the risk of consuming food contaminated with bacteria.

Keywords —Ready-to-eat foods, night market, huahin, coliform bacteria

Background

Street Food, is considered fast food that is prepared quickly and sold to consumers for immediate consumption. It is primarily sold on the streets or in public areas and comes in various forms such as stalls, carts, and small shops, as well as larger restaurants that offer different types of dishes. Street food is regarded as a good dining option due to the variety of menu options and cost-effectiveness when compared to restaurants, eateries, or hotels in Thailand. Street food has gained significant popularity to the point where CNN ranked it as the best street food in the world in 2016. [1,2] Additionally, street food is a lower investment compared to restaurant and hotel businesses, which is a contributing factor to the continuous growth of the street food industry in Thailand. Street food establishments can be commonly found both in Bangkok and various provinces, especially in tourist areas. These establishments offer a wide range of food options for tourists and local residents in different regions. [3,4]

Street food, however, presents health challenges [5]. This is because food preparation and vending in roadside or temporary stall areas may lack convenient facilities for cleaning ingredients before cooking or washing. Cleaning utensils used in food preparation, which is essential for hygiene, might be inadequate. As a result, street food carries risks of contamination from both chemical residues and microbial impurities. For instance, chemical residues from pesticides on uncleaned vegetables used in food preparation may persist. Moreover, beyond this, health and environmental concerns related to the cleanliness of containers, food preparation equipment, food packaging, and the personal hygiene of food preparers and servers in food establishments can lead to food contamination [6].

Food sanitation inspection can be performed by examining the quantity of bacteria in food, such as coliform bacteria. The presence of a high quantity of coliform bacteria in food and water indicates a lack of cleanliness and proper hygiene. It may suggest contamination from human or warm-blooded animal feces, which plays a crucial role in the spoilage of various foods and can lead to foodborne infections. Coliform bacteria can be divided into two groups based on their environmental habitat. 1) Fecal coliforms reside in the intestines of humans and warm-blooded animals and are expelled with feces. Examples of bacteria in this group include *Escherichia coli*. 2) Non-fecal coliforms are found in soil and plants and are less hazardous than the first group. They serve as indicators of water cleanliness. These indicators help assess the cleanliness of water [7].

One popular destination is Hua Hin District in Prachuap Khiri Khan Province. Hua Hin is a significant tourist city for both international and Thai tourists. The district boasts a night market that serves as a major hub for selling large quantities of food to tourists. Researchers are therefore interested in studying the contamination of coliform bacteria in various types of Street Food sold in these popular night markets. This information can aid in making informed choices when purchasing food. Additionally, it serves as a policy guideline to improve the food distribution practices of food vendors, with a focus on prioritizing consumer safety.

Objective of the study

1. To study the prevalence of coliform contamination in ready-to-eat food sold in the night market.
2. To compare the prevalence of coliform contamination in ready-to-eat food sold in the night market, segmented by individual markets.

Study methods

This research is a survey-based study aimed at examining the contamination of coliform bacteria in ready-to-eat food items sold in three night markets located in Hua Hin District, Prachuap Khiri Khan Province. Samples of six types of ready-to-eat food, including stir-fried dishes, deep-fried dishes, grilled dishes, salads, ready-to-eat rice dishes, and desserts, were randomly collected. Each type consisted of 10 samples from each of the three night markets, totaling 60 samples. The sampling was conducted from 18:00 to 20:00 on July 15-17, 2023. Subsequently, the coliform contamination in the ready-to-eat food samples was tested using a coliform testing kit produced by the Pharmaceutical Organization, and the test results were read within 24 hours after testing.

Equipment

1. The coliform testing kit for food consists of one set.
 - Test paper in pouch form 30 pieces
 - Germ-free medicine injection vial 60 pieces
 - Germ-free plastic bag 30 bags
 - Test liquid 1 30 bottles
 - Test liquid 2 30 bottles
 - Cotton and alcohol bottle 1 set
 - Disinfectant 1 bottles
2. Weighing scale
3. Scissors
4. Metal spoon with handle
5. Lighter

Test Procedure[8]

1. The inspector uses alcohol-soaked cotton to wipe both sides of the spoon, scissors, and food container in the designated area that requires use.
2. Use a plug to cut open the food container after it has cooled down.
3. Use a plug to cut open the spoon, let it cool down before using it to scoop food.
4. Weigh 11 grams of food and place it in a germ-free plastic bag.
5. Pour one bottle of solution into the bag and vigorously shake it at least 25 times.
6. Use a medicine syringe to extract 1 milliliter of water from the bag.
7. Inject it into the bottle of solution, close the lid, and vigorously shake it at least 25 times.
8. Use a new medicine syringe to extract 1 milliliter of water from the bottle of solution.
9. Take the water and inject it into the test paper pouch.
10. Gently squeeze out the air from the test paper pouch, seal it tightly, and store it in a dark room at room temperature for 24 hours.

Interpretation

According to the Food Testing Kit Manual from the Department of Medical Sciences, it sets the quality standard for ready-to-eat food, specifying that the Most Probable Number (MPN) of coliforms/gram must

be less than 500. For ready-to-eat food sold from carts or floating platforms, the assessment is conducted as follows:

Number of red spots: 0-4 spots indicates passing the standard.

Number of red spots: 5 spots or more indicates failing the standard.

To determine the number of coliforms in 1 gram of food, multiply the number of red spots by 100.

Data Analysis

The information obtained from this study has been analyzed using descriptive statistics, frequencies, and percentages.

Results

From the examination for coliform bacteria contamination in the 60 samples of ready-to-eat food, the following results were obtained, in 19 samples (31.67%), the Most Probable Number (MPN) of coliforms/gram was found to be greater than 500, indicating they did not meet the standard. This category included 2 samples of stir-fried dishes (20%), 3 samples of grilled dishes (30%), 10 samples of salads (100%), 3 samples of ready-to-eat rice dishes (30%), and 1 sample of dessert (10%). In 41 samples (68.33%), the MPN of coliforms/gram was found to be less than 500, indicating they met the standard. These results are presented in Table 1.

Table 1: Results of Coliform Testing in Samples of Ready-to-Eat Food with Coliform MPN Greater than 500, Categorized by Food Type

No.	Food Type	No. of Sample n	Coliform MPN Greater than 500 (Does not meet the standard) n (%)	Coliform MPN Less than 500 (Meets the standard) n (%)
1	Stir fry	10	2 (20.00)	8 (80.00)
2	Deep fry	10	0 (0.00)	10 (100.00)
3	Grilled	10	3 (30.00)	7 (70.00)
4	Salad	10	10 (100.00)	0 (0.00)
5	Ready to eat rice	10	3 (30.00)	7 (70.00)
6	Dessert	10	1 (10.00)	9 (90.00)
	Total	60	19 (31.67)	41 (68.33)

The results of testing for coliform in ready-to-eat food samples, categorized by the source of purchase from all three markets, revealed the following: From Market 1, out of 12 samples, it was found that 5 samples had a coliform MPN (Most Probable Number) greater than 500 (did not meet the standard), accounting for 41.66%. These samples included 2 grilled dishes, 2 salads, and 1 ready-to-eat rice. From Market 2, out of 30 samples, it was found that 8 samples had a coliform MPN greater than 500 (did not meet the standard), accounting for 26.67%. These samples included 1 stir-fry, 1 grilled dish, 5 salads, and 1 ready-to-eat rice. From Market 3, out of 18 samples, it was found that 6 samples had a coliform MPN greater than 500 (did not meet the standard), accounting for 33.33%. These samples included 1 stir-fry, 3 salads, 1 ready-to-eat rice, and 1 dessert. This information is summarized in Table 2.

Table 2: Results of Coliform Testing in Ready-to-Eat Food Samples, Segmented by Purchase Source

No.	Food Type	Market 1		Market 2		Market 3	
		No. of Sample n	Coliform MPN Greater than 500 (Does not meet the standard) n (%)	No. of Sample n	Coliform MPN Greater than 500 (Does not meet the standard) n (%)	No. of Sample n	Coliform MPN Greater than 500 (Does not meet the standard)
1	Stir fry	2	0 (0.00)	5	1 (20.00)	3	1 (33.33)
2	Deep fry	2	0 (0.00)	5	0 (0.00)	3	0 (0.00)
3	Grilled	2	2 (100.00)	5	1 (20.00)	3	0 (0.00)
4	Salad	2	2 (100.00)	5	5 (100.00)	3	3 (100.00)
5	Ready to eat rice	2	1 (50.00)	5	1 (20.00)	3	1 (33.33)
6	Dessert	2	0 (0.00)	5	0 (0.00)	3	1 (33.33)
	Total	12	5 (41.66)	30	8 (26.67)	18	6 (33.33)

Discussion

Based on the results of the examination for coliform bacteria contamination in the ready-to-eat food samples, comprising 60 samples from three popular night markets in Hua Hin district, Prachuap Khiri Khan province, the findings are as follows: Out of the 60 samples, 19 samples (31.67%) showed the presence of coliform bacteria with an MPN (Most Probable Number) greater than 500 per gram, indicating that they did not meet the standard. These samples included 2 grilled dishes, 2 salads, 1 fried dish, 1 rice dish, and 1 dessert. On the other hand, no coliform bacteria were detected in the deep-fried food samples. This may be attributed to the physical layout of the temporary stalls and kitchens in the night markets, which are situated in open areas and may be exposed to dust particles or airborne coliform bacteria before serving. Furthermore, the utensils and containers used for food preparation may also have traces of coliform bacteria, contributing to contamination when used for cooking [6]. The presence of coliform bacteria in the food samples indicates poor hygiene and sanitation practices. It is crucial for food vendors to prioritize cleanliness and hygiene, including thorough handwashing, proper equipment and utensil cleaning, and regular sanitization to ensure food safety.

The results of this study indicate that coliform bacteria were found in all samples of the salad-type food, accounting for 100.00%. This may be attributed to the preparation method of the salad-type food, where not all components are thoroughly cooked, potentially leading to the presence of coliform bacteria. Additionally, Thailand's hot and humid climate encourages rapid bacterial growth, which may explain the higher prevalence of coliform bacteria in the salad-type food samples. These findings align with the research conducted by ChawalratSomnuek [7], which also observed the presence of coliform bacteria in

food samples, particularly in salad-type dishes. In this study, 30 samples of ready-to-eat food were examined, revealing an 83.33% coliform bacteria contamination rate based on the Most Probable Number (MPN) method. The highest incidence of coliform bacteria was indeed found in the salad-type food. Similarly, the study conducted by WarandeeBanyatirat and colleagues [9], which investigated 81 samples of prepared food, identified coliform bacteria exceeding the standard in 52 samples, accounting for 64.20%. Once again, the salad-type food exhibited the highest occurrence of coliform bacteria contamination. These findings underscore the importance of maintaining strict hygiene and sanitation practices, especially in the preparation of salad-type dishes, to ensure food safety and prevent bacterial contamination.

In this study, coliform bacteria were not found in any of the 10 samples of fried food. This could be attributed to the high cooking temperatures and slow cooling process involved in frying, which leads to the destruction of various bacteria in the food. Additionally, fried food is often served hot immediately after preparation due to its crispy texture and appealing taste. This practice further reduces the chances of coliform bacterial contamination. The results of this study are consistent with the research conducted by NitayaSrimueang and colleagues[10], which focused on the contamination of coliform bacteria in ready-to-eat prepared food. Their study revealed that fried food had a lower incidence of coliform and fecal coliform contamination compared to salad-type dishes. However, these findings contrast with the study conducted by ChawalratSomnuek and colleagues[7], which found a higher incidence of coliform bacteria in fried food compared to other types of ready-to-eat food. This may be due to the sampling taking place in cafeteria settings within educational institutions, where food is often prepared early in the day for later consumption. The prolonged waiting time before sale could potentially lead to an increase in bacterial count. In summary, the quantity of coliform bacteria appears to increase over time during the waiting period for sale, especially in foods that are served hot[11]. This emphasizes the importance of maintaining proper food handling practices to ensure food safety.

Conclusion

Out of the total 60 samples of ready-to-eat food, coliform bacteria were detected in 19 samples, accounting for 31.67%. These samples were categorized as follows: Stir-fried dishes: 2 samples (20%)

Grilled dishes: 3 samples (30%), Salad dishes: 10 samples (100%), Ready-to-eat rice dishes: 3 samples (30%), and Desserts: 1 sample (10%). On the other hand, 41 samples (68.33%) passed the criteria and were free from coliform contamination.

Recommendation

Consumers should choose to consume food from night markets that have passed the standard health inspection. Additionally, it is advisable to select freshly cooked food for consumption

References

- [1] UTRAY [Internet]. Bangkok: UNIVERSAL TRAYS CO., LTD.; c2023 [cited 2023 Aug 16]. Available from:<https://www.utray.co.th/en/article/detail/bangkok-street-food-ตลาดนัดปลาดิบของอาหารริมทาง>
- [2] สถาบันอาหาร [Internet]. Bangkok: National Food institute; 2560 [cited 2023 Aug 16]. Available from: <https://fic.nfi.or.th/market-intelligence-detail.php?smid=145>
- [3] Thai SMEs Center [Internet]. Bangkok: SME CENTER COMPANY LIMITED; 2562 [cited 2023 Aug 16]. Available from: <https://www.thaismescenter.com/โอกาส-street-food-ไทย-ปี-2563/#:~:text=ปัจจุบันธุรกิจร้านอาหารริม,ประเทศได้ขึ้นอย่างคึก>
- [4] BestPrice Travel [Internet]. Bangkok: BestPrice Travel; 2010 [cite 2023 Aug 16]. Available from: <https://www.bestpricetravel.com/travel-guide/yaowarat-chinatown.html>
- [5] Post today [Internet]. Bangkok: THE POST PUBLISHING PUBLIC COMPANY LIMITED; 2560 [cite 2023 Aug 16]. Available from: <https://www.posttoday.com/politics/474350>
- [6] Punyauppa-path K, Kiatprasert P, Punyauppa-path P. Street Foods and Beverages: Consumers Safety. EAU Heritage Journal Science and Technology [Internet]. 2563 [cited 2023 Aug 16]. 14(2):8-24. Available from:<https://he01.tcithaijo.org/index.php/EAUHJSci/article/download/241616/166059/>

- [7] Somnuk C, Charoenwiset L Coliform Bacteria Examination in Ready to Eat Food at RambhaiBarni Rajabhat University. Rajabhat RambhaiBarni Research Journal [Internet]. 2559 [cite 2023 Aug 16]. 10(2):89-94. Available from: <https://opac01.rbru.ac.th/multim/journal/03272.pdf>
- [8] Guide to using food testing kits [internet]. [cite 2023 Aug 16]. Available from: <http://bqsf.dmsc.moph.go.th/bqsfWeb/wp-content/uploads/2017/06/test-kit/7-coliform%20in%20food.pdf>
- [9] Bunyatrchata W, Thaboran S, Somdce T, Kong-ngn K. Detection of Some Bacteria in Cooked Foods in KhonKaen University Campus. KKU Research Journal [Internet]. 2545 [cite 2023 Aug 16]. 7(1):38-50. Available from:https://rtt.kku.ac.th/ejournal/pa_upload_pdf/737049.pdf
- [10] Srimuang N, Lertsongkram K, Prokaew P, Kumyoung N. Contamination of Coliform bacteria in ready-to-eat foods for monks in Kut Pong Subdistrict, Mueang Loei District, Loei Province. 1rd National Conference in Science, Technology and Innovation 2019; 2019. N.368-373. [cite 2023 Aug 16]. Available from: https://ncst.lru.ac.th/downloadPaper.php?paper_id=53
- [11] Thongprasert C, Wattanasomboon P, Lakshmicharunkul P, Singhakant C. Related factors and indicators of bacterial contamination in sushi from indoor and outdoor stores. Journal of Public Health [Internet]. 2558 [cite 2023 Aug 16]. 45(3):244-525. Available from: https://www.ph.mahidol.ac.th/thjph/journal/45_3/02.pdf