



Prevalence Of Coliform Bacteria In Street Foods Sold Around School In A Number Of Areas In Bangkok Metropolitan

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Abstract

In Thailand, street food is consumed widely among citizens, especially consumers at a studying age. This is because of its convenience in consumption, as well as its affordable price. However, there is a considerable risk of microbial contamination in street food. Therefore, this study's aim was to investigate the level of coliform bacteria contamination in street menus which were frequented by high school students in Bangkok. In this investigation, 24 samples were purchased randomly from food stalls in the areas and were examined aseptically with a coliform test kit in the laboratory on the next day. The test results were then compared to the biological criteria for ready-to-eat food devised by the Ministry of Public Health. According to the findings, the proportion of non-standard contamination accounted for 37.5 percent. The unheated food samples had higher rates of coliform infection (60%) than those in heat-treated food samples (31.58%). This study showed that microorganisms are more likely to contaminate street foods which are not heated than heat-treated ones. However, despite the heating process, there are other factors that possibly contribute to harmful amounts of bacterial contamination in street menus, for instance, the vendor's inadequate hygiene, an open environment caused the food exposed to for all day and unheated seasonings added to a pre-heated food.

Keywords: Street food, Test kit, Coliform bacteria

Introduction

Despite the fact that food is indispensable for humans' living, consumption of contaminated food potentially contributes to several fatal illnesses. According to the World Health Organization (WHO), approximately 10% of the world population suffers from foodborne diseases, and 420,000 deaths are reported. One of the leading causes of the diseases is the contamination of harmful microorganisms; infectious pathogens including Salmonella, Campylobacter, and Enterohaemorrhagic Escherichia coli affect millions of people every year with symptoms, mainly diarrhea, vomiting, and fever annually.[1] Food infection is a consequence of

mishandling of food and poor hygiene in food preparation and restoration. Outbreaks of foodborne illness are also among the most concerning health issues in several developing countries. The Bureau of Epidemiology, Department of Disease Control, Thailand Ministry of Public Health, Thailand revealed that over 1,000 citizens got diarrhea from 2012 to 2019, while several studies indicated a high prevalence of unsafe food in the country.[2]

Similar to hygienic aspects, bacterial contamination in food can be tested by coliform counting. Although coliform is not considered harmful, they indicate fecal contamination and the presence of particular pathogens in food as they are generally found in the

digestive tracts of humans and homeothermic animals.[3]

As a result of this, the Ministry of Public Health has provided access to the microbiological quality of ready-to-eat menus by determining the limit of 500 in coliform counting per 1 gram of food and the maximum permissible limit of harmful microbes, including *Bacillus cereus*., which can secrete enterotoxin and *Salmonella* spp., which can cause infection, gastroenteritis, septicemia, and typhoid fever. According to the Safe Food Production and Logistics Project, samples from diverse sources across Thailand were investigated to summarize the prevalence of unqualified food based on these biological requirements. The data reveals that from 2013 to 2018, 56.4% of meatball samples failed to fulfill biological measures, while the prevalence of unqualified sausage samples reached its peak at 71.2% at the end of the same period. In addition, there was also a prediction of annual growth in

later years.[4] A study by rambhai Barni rajabhat University in 2016 showed that among ready- to-eat menus, 100% of spicy salad or chili dip samples were highly contaminated by coliform bacteria, followed by 90% of the group of fried menus and soup or curry.[5] A retrospective study of Kittima Maitreepadubsri, B.S. represented information from 2015 to 2019, showing that 81% of total samples were found unqualified due to coliform and pathogenic bacteria, which caused food poisoning.[6]

Nutritious food is essential to human beings, especially for teenagers. Most of them may have eaten street food which is convenient and affordable. But some of them might experience diarrhea. Food cannot be entirely safe especially street food which has a poor hygienic practice of the vendors, consisting of improper cooking, inadequate food storage temperature, and food contamination can be all sources of microbial hazard to customers.[7] According to the study of the contaminated coliform bacteria in food stands of raman, yala province in the south of Thailand[8], it was reported that the detection of coliform bacteria in food was 75.3% of the samples. Food safety is threatened by numerous pathogens and bacteria that cause various foodborne diseases in the short and long term. Foodborne diseases have exerted pressure on medical services, contributed to economic and political distress, exacerbated malnutrition, and led to human suffering.

The Disease surveillance data from the Bureau of Epidemiology, Department of Disease Control in 2016 reported that 138,595 food poisoning patients with no deaths and 1,202,813 diarrhea with 5 deaths were found. Moreover in 2017, from January 1-May 1 2016, 337,003 diarrhea cases and 38,893 food poisoning cases were reported. It was caused by consuming food that had not been heated or reheated. Moreover, foods containing chicken and eggs that were not cooked, for example, salad dressing or mayonnaise that had raw yolk, may have *Salmonella*, which causes diarrhea.[8]

regarding these reports, the spreading of foodborne diseases originated from food

sources caused by the lack of knowledge of the food sellers on the food safety that related to the poor sanitation. In addition food preparation together with obtaining drinking water and not removing waste could lead to microorganism found in the food. Overall, from the food contamination in Bangkok reports, the tendency remained stable from 2015 to 2019 and decreased in 2020 by 0.11 % but in 2021, the contamination increased by 0.14%. [10]

The mentioned literatures reflects the presence of microbial contamination particularly in street food, which is relatively accessible for young age consumers in Thailand. Several surveys informed that the prevalence rates of non-standard contamination, mainly by harmful microbes, in street menus usually accounted for higher percentages than other types of food. Therefore, for the sake of food safety among studying age consumers, this study's aim was to investigate coliform contamination happening in some popular street food consumed by the high school students, which was sold in food stalls around the area of Bangkok, Thailand. The results from this study will be enumerated to provide information regarding microbiological quality for careful consideration of consumption of street food.

Materials Methods Instrument And Tools

Using a Coliform test kit developed by Department of Medicine Sciences, Ministry of Public Health which can test if there is an exceed standard of coliform bacteria in street food. This test kit can give the results within 24 hours. [10]

Sample collection and preparation

Applying Convenience Sampling Method, a total of 24 various samples of popular street menus among students consisting of 1 sample of fried chicken, 1 sample of roasted chicken, 2 samples of bread, 2 samples of boba tea, 3 samples of sushi, 2 samples of mini pancake roll, 1 sample of rotee, 1 sample of fried meatball, 4 samples of roasted meatball, 3 samples of roasted sausage, 1 sample of roasted pork, 1 sample of roasted fermented pork, 1 sample of barbeque and 1 sample of fried bacon were purchased from a number of areas in Bangkok (Vadhana, Phya Thai and Chatujak) in the evening on March 26th, 2022. The samples then had been kept at 2-8 degree Celsius before being tested aseptically on March 27th, 2022.

Equipment

The test kit which comprises of test paper, sterile syringes, sterile plastic bags, and solution no.1, and no.2. The rest are cotton, ethyl alcohol, a weighing scale, scissors, a metal spoon and a lighter.

Procedure

The first stage was to clean both hands, metal spoon, scissors, and the opening of food package with

alcohol. The scissors, as well as the spoon, was sterilized with a lighter before being used to cut the food packaging. After that, 11 g of each food sample was scooped with the sterilized spoon and put into a sterilized plastic bag. Next, a full bottle of solution no.1 was poured in to each bag before the bag was shaken vigorously for 25 times. 1 mL of liquid from the bags, then, was aspirated by a sterilized syringe and drained into another bottle which contained solution no.2. After closing the lid tightly, the bottle was shaken for 25 times, again. Then, a new syringe was used to aspirate 1 mL of the ultimate liquid and drained into the test paper which was in the small plastic plate. Finally, the bag had been closed and kept for 24 hour in the room temperature without an exposure to the light and then checked for the red dots if appeared on it.

Result Interpretation

The Interpretation was carried out by counting the red dots on the test papers. This performance was followed the standard criteria of the test kit devised by Department of Medical Sciences that if there were more than 4 red dots, the sample was not standardized (Table 1).

Table 1. The criteria for ready-to-eat food by using the test kit

Types of food	the number of red dots	criteria	The number of coliforms bacteria in 1 g of food
ready meal	0 - 4	pass	The number of red dots \times 10
Stall food, school and restaurant	5 or $>$ 5	fail	

Result

In this investigation, the aerobic count plate was applied. Thereby, the red spots

appearing on each test paper lined in the count plate indicated colonies of coliform bacteria contaminating in a relative sample.

Among the total of 24 samples, there were 9 samples (37.5 percent of total food samples) which showed the more than of 4 red spots on their test papers (Table 2).

When taking the variety of the street food types into consideration, sushi was most heavily contaminated by coliform bacteria, accounting for 3 samples (100 percent of all sushi samples), followed by 2 samples

of grilled meatballs and mini pancake rolls as 50 percent and grilled sausages as 33.33 percent respectively. While both roti and barbecue whose only 1 sample was collected in each type, showed positive results in coliform bacterial testing. the other street menus consisting of 1 sample of fried chicken,

1 sample of grilled chicken, 2 samples of bread, 2 samples of boba milk tea, 1 sample of fried meatball, 1 sample of grilled pork, 1 sample of sour pork and 1 sample of pork bacon showed negative ones. (Table 2).

Table 2. Summary of coliform investigation in food stalls (n=24)

No.	Sample	No. of Sample	number of red point in sample 5 or >5
1	Fried chicken	1	0
2	Grilled chicken	1	0
3	bread	2	0
4	Boba tea	2	0
5	Sushi	3	3
6	Mini pancake roll	2	1
7	rotee	1	1
8	Fried meat ball	1	0
9	roasted meat ball	4	2
10	roasted sausage	3	1
11	roasted pork	1	0
12	roasted fermented pork	1	0
13	Barbecue	1	1
14	Fried bacon	1	0
	total	24	9

When dividing the food samples into 2 groups: heated menus and non-heated menus, the results revealed that 19 samples (79%) were heated, while the 5 others were not. Among the heated food, 31% were considered as contamination. When turning to the non-heated, unqualified contamination was found in 60% as shown in Table 3.

Table 3. Summary of coliform investigation in food stalls categorized by heating

	number of red points in simple 0-4 n (%)	number of red points in simple 5 or >5 n (%)	Total
Heat	13 (68.4)	6 (31.58)	19
Non Heat	2 (40)	3 (60)	5

Discussion

According to Thai Journal of Public Health, sushi sold in a stall and food cart had significantly higher rates of coliform and fecal coliform contamination when compared to those sold in an internal shop; also, the rate increased due to the longer time they had been for sale. This mentioned study emphasized the idea that street food was a relatively concerning group when it came to biological hazards. In other words, as street menus were sold outdoors, surrounded by an open environment from dawn until dusk, an exposure to pathogens was found in every single stage ranging from preparation, handling and supplying. [11]

The largest proportion of the menus used in this investigation, accounting for 79%, were heated before consumption commonly. When taking solely heated food into consideration, 68% of those were contaminated by coliform bacteria. Meanwhile, among iced beverage which was tested, unacceptable rates of contamination (0%) were found. However, the microorganisms contaminated were found in all sushi samples (100%), which were not served hot. This was similar to that of a previous survey on street food around primary school in Muang District, Chonburi Province, where 100% of sushi sold in the area were contaminated by the coliform. [12]

In order to alleviate and prevent microbial food safety hazards, food should be heated before being consumed. However, some of the grilled foods and fried foods included in this study were revealed to be contaminated by coliform bacteria, leading to the

hypothesis that there were also other factors which potentially contribute to microbiological contamination in heated menus.

Frying is a process using the heat of 170 to 210 degree Celsius, so this way of food preparation has potential to eliminate most pathogens, which start to die at 77 degree celsius. Nevertheless, 1 fried sample (roti) was considered contaminated, which was like to the unheated sushi samples, was possibly due to the mishandling including the direct touch.

Biological quality might be affected by unhygienic preparation of food. According to the study on food safety of mobile market in Meiwadi municipality, Moeiwadi district, Roi Et Province, 59.7% and 27% of food containers and tools used in food preparation and food vendors' hands were found contaminated by coliform, potentially contributing to contamination in food.[13] Furthermore, adding non-heated condiments to heated food, including adding sweetened condensed milk despite how hot a roti is served, could also increase the possibility of bacterial contamination, cohering with the study in 2007, which indicated that well-cooked meal could be contaminated due to adding fresh and non-heated side dishes such as vegetable.[14]

However, this study was of some limitation which might hinder the accurate analysis. Firstly, the food samples were kept in different places before the investigation due to the different distances from the area where they were purchased. In addition, because the numbers of samples were quite limited, thorough

summary about various street menus could not happen.

Conclusion

According to this study, non-heated foods had a higher risk of microbial contamination when compared to heated foods. However, despite a heating process, heated foods are not without the bacterial contamination. Therefore, consumers still have to be concerned about biological hazards in both types of ready-to-eat food.

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