

# Identification of Coliform bacteria content in 'Thai Tea' drinks and its correlation with hygiene factors in Yogyakarta, Indonesia

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## Abstract

**Background:** Various water-borne diseases have been seen in developed and developing countries, like Coliform bacteria in food and drink due to their poor making.

**Objective:** This study aims to estimate the hygiene factors and examine the content of Coliform bacteria and in Thai Tea drinks in Yogyakarta Municipality.

**Methods:** A cross-sectional method was used in all Thai Tea product sellers in Yogyakarta Municipality from September to November 2020. A total of 30 sellers were included, and 30 different types of Thai Tea products were tested using the Most Probably Number (MPN) method at the Health and Calibration Laboratory Center, Yogyakarta, Indonesia. Descriptive statistics, Chi-square, and Fisher exact test were used for data analysis.

**Results:** Laboratory tests showed half of Thai Tea products contaminated with Coliform bacteria more than MPN/100ML. Of all Thai Tea sellers, about 83.3% of them were never hygiene food sanitation training. Findings also show that the seller's hygiene sanitation was significantly associated with the existence of Coliform bacteria in Thai Tea (Crude OR=0.44, 95% CI=0.20-0.98). The sellers with poor sanitation facilities were four times more likely to have Coliform bacteria in their Thai Tea products (Crude OR=4.0, 95% CI=1.41-11.35). Meanwhile, hygiene food sanitation training and location of selling did not have a significant relationship with the presence of Coliform in Thai Tea.

**Conclusion:** In sum, the existence of Coliform in Thai Tea drinks in the city of Yogyakarta is influenced by the hygiene sanitation and sanitation facility. Training on personal hygiene for each seller is necessary to obtain Thai Tea products that contain Coliform bacteria according to standards. This is very useful to do to reduce food-borne disease.

Keywords: hygiene sanitation; sanitary facilities; Coliform bacteria; Indonesia

## Background

Poor hygiene and handling practices of street food sold can pose a significant potential hazard to public health (Mwove, Imathiu, Orina, & Karanja, 2020).

Therefore, the food or drink sold in street foods must meet the requirements of good food hygiene and sanitation (Shaanika, 2020). According to the Regulation of the Minister of Health of the Republic of Indonesia number 942 / MENKES / SK / VII / 2003

regarding the guidelines for the hygiene requirements of street food sanitation, it is stated that the street food handlers in carrying out the activities of handling snacks must meet the criteria as the following: not suffering from easily transmitted diseases (coughs, colds, influenza, diarrhea, stomach ailments like that), covering wounds (on open wounds/ulcers or other wounds), maintain cleanliness (hands, hair, nails, and clothes), wearing aprons and headgear, washing hands every time you want to handle food, touching food must use tools/equipment or with hand mats, not smoking, not scratching limbs (ears, nose, mouth or other parts), and not coughing or sneezing in front of snack food served and or without covering mouth or nose (Ministry of Health Republic of Indonesia, 2003).

Sellers who do not know about hygiene personal will risk contaminating harmful bacteria in the food they sell (Ghosh, Nurain, Hasan, Raihan, & Akter, 2020). Like, research in Medan, which aims to identify the content of Coliform bacteria in drinks, shows that almost all samples contain Coliform bacteria above the normal limit standard (Simaremare, 2020). Coliform bacteria are usually easily found in drinking water (Kita, Sihabut, & Tantrakarnapa, 2020). This bacteria can be an indicator in determining the suitability of food or drinks because the presence of these bacteria is a sign if there is contamination from other bacteria that can also cause various kinds of diseases, one of which is diarrhea (Mawarni, Hestningsih, Kusariana, & Wuryanto, 2019; Rostina & Mutiana, 2019; Sinaga, Robson, Gasong, Halel, & Pertiwi, 2016). Diarrheal disease is a health problem for all ages, which shows that in 2019 there were 9,465 people, reported by Yogyakarta Municipality Health Office (Dinas Kesehatan Kota Yogyakarta, 2020).

The establishment of the ASEAN Economic Community (AEC) in 2015 (Tosepu, 2017) making the entry of various foods and beverages from outside Indonesia, such as Thai Tea from Thailand. The 'Thai Tea' is a drink that originated in Thailand and is known by its original name, namely "Cha Yen" which means cold tea. This drink is very popular among young people and the elderly. Therefore, until now, there are so many of these drinks available in food stets in Indonesia. However, because this is a new product, Indonesia still does not have a hygienic Thai tea-making standard procedure (Atieq, Rizqi, & Sindu, 2020).

As a municipality that is a place of visit for domestic and international tourists, Yogyakarta must pay attention to the quality and quality of street food products sold by vendors selling. Therefore, this study aims to estimate the content of Coliform bacteria in Thai Tea drinks in Yogyakarta Municipality, Indonesia 2020.

## Methods

### Study Design

This was a cross-sectional study conducted between September and November 2020.

### Sample

The sample in this study consisted of 30 Thai Tea traders and 30 types of Thai Tea drinks with different brands by total sampling technique. The population in this study were all Thai Tea sellers in the city of Yogyakarta. The inclusion criteria for the respondent and Thai Tea sampling were 1) the seller stayed in the shop when the researcher collected the data, 2) the seller worked more than three months in that shop, 3) Thai Tea samples must be Thai Tea products.

### Measures

Laboratory tests in this study were conducted from October to November 2020 at the Health and Calibration Laboratory Center, Yogyakarta. Thai Tea samples were examined using the Most Probably Number (MPN) method. The standard of Coliform content in food is no more than 100 MPN / 100ML. If more than the standard, the drink is categorized as not eligible for consumption.

In addition, observation checklists were made using a checklist divided into three parts, including characteristics of respondents, hygiene sanitation, and sanitation facility used in the list of observations by the Ministry of Health Indonesia. Characteristics of the respondent included sex (male and female), sellers' status (employees and owners), hygiene sanitation training (have ever been and never), and selling locations (permanent building and tent use). The observations were conducted in September 2020.

The hygiene sanitation was examined using a checklist of 22 questions and the sanitation facility (9 questions). The correct question gets a score of '1', and the wrong question receives a score of '0'. The

total score was classified into three groups using Bloom's criteria: good (> 80%), moderate (60%-80%), and poor (< 60%). Before filling out the observation checklist, the researcher received prior approval from the seller.

### Data Analysis

Data were analyzed using descriptive statistics, Chi-Square, and Fisher exact test. IBM SPSS Statistic Ver. 2.0 software was used in this study (<https://www.ibm.com/support/pages/downloading-ibm-spss-statistics-20>).

### Ethical Consideration

This study was ethically approved by the Faculty of Public Health, Ahmad Dahlan University (Certificate permit number No. F10/070/I.0/II/2020).

### Results

Table 1 shows that about 15 samples (50%) were having result tests more than 100 MPN/100ML, which indicated that the Thai Tea contaminated by Coliform bacteria and considered high.

**Table 1** Identification existence of Coliform bacteria in Thai tea

Number of Sampling	Date (in 2020)	Parameter	Result	Unit
017852/M/10/2020	October 5	Coliform bacteria	>1100	MPN/100ML
019815/M/11/2020	November 10	Coliform bacteria	9.2	MPN/100ML
019821/M/11/2020	November 11	Coliform bacteria	>1100	MPN/100ML
017851/M/10/2020	October 5	Coliform bacteria	>1100	MPN/100ML
018378/M/10/2020	October 9	Coliform bacteria	>1100	MPN/100ML
019817/M/11/2020	November 10	Coliform bacteria	<3	MPN/100ML
019338/M/11/2020	November 3	Coliform bacteria	460	MPN/100ML
019816/M/11/2020	November 10	Coliform bacteria	<3	MPN/100ML
019330/M/11/2020	November 3	Coliform bacteria	9.2	MPN/100ML
019337/M/11/2020	November 3	Coliform bacteria	3.6	MPN/100ML
018377/M/10/2020	October 13	Coliform bacteria	>1100	MPN/100ML
019819/M/11/2020	November 10	Coliform bacteria	460	MPN/100ML
019822/M/11/2020	November 10	Coliform bacteria	460	MPN/100ML
017849/M/10/2020	Oktober 5	Coliform bacteria	43	MPN/100ML
019818/M/11/2020	November 10	Coliform bacteria	>1100	MPN/100ML
019820/M/11/2020	November 10	Coliform bacteria	21	MPN/100ML
018380/M/10/2020	October 13	Coliform bacteria	>1100	MPN/100ML
019334/M/11/2020	November 3	Coliform bacteria	>1100	MPN/100ML
018379/M/10/2020	October 13	Coliform bacteria	23	MPN/100ML
019814/M/11/2020	November 10	Coliform bacteria	9.2	MPN/100ML
018382/M/10/2020	October 13	Coliform bacteria	9.2	MPN/100ML
017850/M/10/2020	October 5	Coliform bacteria	>1100	MPN/100ML
019339/M/11/2020	November 3	Coliform bacteria	>1100	MPN/100ML
019813/M/11/2020	November 10	Coliform bacteria	<3	MPN/100ML
018381/M/10/2020	October 13	Coliform bacteria	>1100	MPN/100ML
019332/M/11/2020	November 3	Coliform bacteria	9.2	MPN/100ML
019333/M/11/2020	November 3	Coliform bacteria	<3	MPN/100ML
019335/M/11/2020	November 3	Coliform bacteria	<3	MPN/100ML
019336/M/11/2020	November 3	Coliform bacteria	>1100	MPN/100ML
017853/M/10/2020	October 5	Coliform bacteria	9.2	MPN/100ML

Table 2 shows that most Thai Tea sellers were females (53.3%), and they were employees (73.3%). Of 83.3% of the sellers have never been trained about food sanitation hygiene, and 53.3% used a

permanent building for selling. Table 3 shows that the hygiene sanitation of sellers was poor (53.3%), but the sanitation facilities were equal.

**Table 2** Frequency distribution of Thai tea seller respondents

Variables	Frequency	Percent
<b>Sex</b>		
Male	14	46.7
Female	16	53.3
<b>Seller's Status</b>		
Employees	22	73.3
Owners	8	26.7
<b>Food Sanitation Hygiene Training</b>		
Has never been	25	83.3
Ever	5	16.7
<b>Selling Locations</b>		
Permanent building	16	53.3
Tent use	14	46.7

**Table 3** Distribution based on hygiene factors and the existence of Coliform in Thai tea

Variables	Frequency	Percent
<b>Hygiene Sanitation</b>		
Good	14	46.7
Poor	16	53.3
<b>Sanitation Facilities</b>		
Good	15	50
Poor	15	50

**Table 4** Relationship of hygiene factors and the existence of Coliform bacteria in Thai tea

Variables	Existence Coliform bac.				RP (CI 95%)	P-value
	Ineligible		Qualify			
	n	%	n	%		
<b>Hygiene Sanitation</b>						
Poor <sup>(ref)</sup>	5	16.6	11	36.6	0.44 (0.02-0.97)	0.028*
Good	10	33.3	4	13.3		
<b>Sanitation Facilities</b>						
Poor <sup>(ref)</sup>	12	40	3	10	4.0 (1.41-11.35)	0.001*
Good	3	10	12	40		
<b>Food Sanitation Hygiene Training</b>						
Never <sup>(ref)</sup>	12	40	13	43.3	0.80 (0.35-1.82)	1.000
Ever	3	10	2	6.7		
<b>Selling Locations</b>						
Permanent building	8	26.7	8	26.7	1.00 (0.49-2.05)	1.000
Tent use <sup>(ref)</sup>	7	23.3	7	23.3		

Table 4 shows that the hygiene sanitation and sanitation facilities had significant associations with the existence of Coliform bacteria in Thai Tea ( $p < 0.05$ ). The sellers who had poor sanitation facilities were four times more likely to have Coliform bacteria in their Thai Tea. There were no significant relationships between food sanitation hygiene training and selling location with the existence of Coliform bacteria in Thai Tea ( $p > 0.05$ ).

## Discussion

This study shows a relationship between the merchant's hygiene sanitation with the presence of Coliform in Thai Tea drinks in the Yogyakarta City area with a value of  $p = 0.028$ . This can happen because most respondents did not use aprons and wash their hands before making Thai Tea. Washing hands is one of the main things that traders must do before or after handling food. Although washing

hands is very easy to do, there are still many traders who underestimate it. This finding is in line with the results of research in Kenya that processed foods that are newly popular in the region need attention to hygiene sanitation because they are prone to coliform bacteria contamination (Malavi, Abong, & Muzhingi, 2021)

The presence of Coliform in Thai Tea can also be influenced by the water (Sinaga et al., 2016). Hygiene sanitation for traders is key in food and beverage processing. Therefore, food handlers must follow the existing provisions to prevent contamination of the food or drinks handled, including washing hands and always maintaining personal hygiene and health (Susanna, Purwanisari, & Ratih, 2020).

The hygiene and sanitation of traders can be influenced by the knowledge or awareness of traders themselves. Knowledge can be influenced by age. The increasing age of a person can have an effect on the increase in knowledge obtained at an increase in knowledge acquired at a certain age or before old age, one's level of knowledge decreases. In adulthood, it is enough to have good knowledge of personal hygiene (Rahman et al., 2018). By having knowledge about the seller's sanitation hygiene or personal hygiene, the sellers will pay more attention to what important aspects must be maintained related to personal hygiene.

The result showed a relationship between sanitation facilities and the presence of Coliform in Thai Tea drinks in the Yogyakarta City area with a value of  $p = 0.001$ . This can be influenced by several sanitation facilities that are not fulfilled, or their use is not optimal. Sanitation facilities are a very important component to minimize the contamination of viruses, bacteria, or other microorganisms (Dandie et al., 2020). All Thai Tea beverage sellers have a place to wash their hands or to wash tools. However, the availability of a place to wash tools or hands for traders who use tents is limited, to using buckets filled with water, not using running water. To meet the requirements, traders provide water for washing hands that are separated from the equipment, such as running water from a tap and a separate bucket between washing hands and washing utensils.

There is also a trash can in every Thai Tea seller, but there are still trash bins that do not meet the

requirements. The trash can is also used to dispose of liquid waste from the previous Thai Tea making. The trash can is made of plastic-coated trash cans and is prone to leakage when the garbage is transported. The use of plastic garbage bins must be appropriately handled not to create a collection of fly or insect vectors that can cross-contaminate. If the plastic trash can is filled, it must be immediately lined up so that it is closed and replaced with new plastic (Lestari, Nurjazuli, & Danudianti, 2015). Indeed, research in Nigeria shows that sanitation and food safety have a significant relationship (Abdullahi, Maiha, & Lawal, 2020).

There was no relationship between food sanitation hygiene training, the location of selling, and the presence of Coliform in Thai Tea drinks. There are 16 locations for selling Thai Tea in Yogyakarta, with permanent buildings and 14 places tents use. The location for selling using a tent generally only can protect the top surface but cannot cover the sides. Thus, selling using tents is easier to get contaminated by dust, motor vehicle fumes, or microorganisms.

There are also many locations for selling using tents on the side of the road that washes utensils only using buckets and does not use running water. But this does not necessarily lead to coliform bacteria contamination in Thai Tea because the statistical results show no relationship between the location of selling and the presence of Coliform in Thai Tea drinks in the city of Yogyakarta. The location for selling or processing food or beverages has a large enough potential to cause health problems due to the food or beverage produced. Locations and buildings that do not meet health requirements will facilitate contamination of food or drinks by microorganisms such as bacteria, fungi, viruses, parasites, and chemicals that can pose a risk to human health. Selling locations in open spaces such as roadsides are prone to contamination by Coliform bacteria such as members of the genus *Escherichia*, *Enterobacter*, *Proteus*, *Shigella*, *Salmonella*, and *Klebsiella* (Maina, 2020).

## Conclusion

In sum, the findings in this study indicated that the Coliform bacteria contamination, which is more than the threshold value, is due to the cleanliness of

sanitation and sanitation facilities in the selling location. Based on these results, it is hoped that policymakers and further researchers will make technical instructions in making Thai tea and other selling products that come from abroad. It is also expected that food and drinks circulating are not arbitrary but have good quality nutritional value.

#### Declaration of Conflicting Interest

The authors declare no conflict of interest.

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#### Author Contribution

D.S. conceived of the presented idea. D.S., H.K. and R.A developed the theory and designed the method. D.S. and H.K. collecting data. S.A. verified the analytical methods. D.S. encouraged H.K. to investigate the laboratory test and R.A. supervised the findings of this work. D.S. and S.N. reviewed, revised the manuscript, edited the manuscripts and publications. All authors agreed on the final draft of the manuscript before submitted for publication.

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