

## **Risk Factors of Contaminated Coliform Bacteria in Food Stand of Raman, Yala Province South Thailand**

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### **ABSTRACT**

This research is the study of the factors risk of contamination with coliform bacteria of food sales on street vendors in Raman district, Yala province south Thailand. This research aimed to study the factors relating to the factors risk of contamination with coliform bacteria of food selling on street vendors in Raman district, Yala Province. The samples were 150 food street vendors' owner, restaurant, or market in Raman district, Yala province. The 450 samples of food, hands, and plates were also detected for coliform bacteria. The research instruments used in the research were examining form and questionnaire. Descriptive statistics included frequency, percentage, mean, chi-square test, and multiple linear regressions.

The results of this research found that most of the samples were female (85.30%) aged between 31-40 years old and 51-60 years old which are equally at 30%. Most of them finished the primary educational level (50%). Most respondents cook themselves (84.00) and they have not passed in food sanitation training (52.70 %).

The criteria for food inspection found that the most passed criteria at 100% were food stalls at least 60 cm. high. The criteria for food selling found that the most passed criteria at 100% were the food additives which must contain food serial number registration. Personal hygienic criteria found the most passed criteria at 100% comprises of 3 aspects which are using equipment to pick up cooked food; avoiding smoking while working on the food; and all cooks must be in a good health, not have a contagious disease, and must have health checkup regularly. The results of the detection of coliform bacteria in food, plate, and cooks' hands revealed that the most of samples were contaminated at 75.30%

The relationship testing found that the factor on food sanitation training, factors on food selling and the results of detection of coliform bacteria in food were statistically significant at 0.05 ( $p < 0.05$ ). For the risk of contamination with coliform bacteria which can be predicted were food sanitation training factor ( $\beta = .310$ ,  $p < .05$ ) and factors on food selling ( $\beta = .340$ ,  $p < 0.5$ ). When the risk was considered, it found that the samples have not been trained in food sanitation and food selling criteria. There is a risk of contamination of contamination of coliform bacteria (Relative Risk = 1.282, 1.329, respectively).

**Keywords:** Risk Factors, Contaminated Coliform Bacteria, Food Stand, Yala Province, South Thailand

### **Introduction**

The food sanitation conditions of various food establishments were still at a non-standard level hygiene, as well as the increased demand for food from food establishments which was in line with the current way of life of Thai people. Therefore, consumers were at risk of developing disease-causing food borne diseases. Non-standardized food establishments were therefore the epidemic. Therefore, stores that were a source of cooking for sale to consumers are therefore very important to the health of people. It was important to focus on food sanitation management in order to prevent various dangers (Vichit Rangpan, 2015). Disease surveillance data from the Bureau of Epidemiology, Department of Disease Control in 2016 found 138,595 food poisoning patients, no deaths and 1,202,813 diarrheas, 5 deaths found. During the summer, an average of 100,000 diarrhea patients were found per month, while food poisoning was found on average over ten thousand patients. For the year 2017, from January 1 - May 1, 2016, 337,003 diarrhea cases and 38,893 food poisoning cases were found. It was caused by eating food that had pathogens such as seafood that was not stored in a cold place that was not grilled or grilled, or food that was used to add fresh vegetables. In addition, Laab type Inadequate Foods containing chicken and eggs such as chicken rice, salad dressing or mayonnaise that had raw egg yolks. Because the chicken and eggs that

were not cooked may had Salmonella which causes diarrhea. In addition, it may be caused by unclean drinking water or ice. Therefore, the Ministry of Public Health recommends that people be more careful when eating foods that were at risk of developing gastrointestinal diseases (Sophon Mekthon, 2017).

In addition, the disease control group The Yala Provincial Public Health Office received a report of patients with diseases that needed to be monitored from the public health service year 2017, found that diarrhea is the disease with the highest illness rate of 4,110 cases, representing 917.58 per hundred thousand population. (Majantasri : 2560). Together with Raman district, Yala province was an area that sells a lot of ready-to-eat food. Which should had a survey of different types of food safety for what type of food is in the criteria, should be careful and consider before consumption in order to be information to the public for consideration to buy food appropriately. The statistics of diarrhea patients in Raman district for the past 5 years there were 705 patients, with a rate of 4,937 per hundred thousand populations. Which has a tendency to increase every year (Netima Chantasri : 2017).

It was absolutely necessary to study in order to use the information to be used in planning, control, prevention, and found ways to make the people consume ready-made food, especially packaged food that was clean, safe, and free from disease.

## **Methodology**

### **1. Population**

It was consisting of 238 cooks or food stall owners selling food on stalls at restaurants or fresh markets in Raman district, Yala province.

### **2. Sample**

The sample was divided into 2 groups.

- 1) 150 cooks or food stall owners have been calculated based on the formula of Taro Yamane (referred to in Puangrat Thawirat), which had a tolerance value of 0.05, which was an example that requires study. 150 of the stall number 238 stalls.
- 2) The samples for coliform screening are 1 food sample collected from 1 panel, 1 container for food and 1 sample of food contact hand, including 150 samples from 450 stores.

## **Materials and Data Collection**

### **Tools used to gather information.**

The instrument used in this research was a test. In which the researcher studied and improvements and additions from the food sanitation inspection form for food stalls of the Department of Health Ministry of Public Health.

Section 1 was a questionnaire about general information. There were 6 items, namely gender, age, education level, distribution status training in food sanitation.

Section 2 was a checklist of food sanitation requirements for food stalls, in 3 areas. There were 5 food selling places. There were 8 items of food distribution and 7 items of personal hygiene.

Criteria-based evaluation all 5 food distribution venues were considered qualified the characteristics of selling food through all 8 criteria were considered to pass the criteria. Personal hygiene, through all 7 items, was considered to pass the criteria.

Part 3 Examination for coliform bacteria in food samples, food containers and the hand of the person who touches the food. Evaluation based on criteria, no coliform bacteria were found in all 3 samples, namely food, food container and the hand of the food contact was considered not contaminated with coliform bacteria. It was found in a sample, one sample was considered contaminated with coliforms.

### Data Gathering

1. Coordinate with the person responsible for food sanitation in all Tambon Health Promotion Hospitals in Raman district, Yala province to clarify the process of collecting sample questionnaires.
2. Ask the panel owner restaurant about general information attending the training food retailer food distribution and personal hygiene.
3. Dress observer of the panel owner / cook
4. Explore the manicure and swab hand, the owner of the food panel and container, by collecting all the panels, including 3 panels each
5. Food samples were collected in October 2017 as the beginning of the financial year. The most up-to-date food stall information was updated. In addition, during this time, the availability of SI-2 reagent, it has been supported by the Raman District Public Health Office.

### Data analysis

The questionnaires that collected the data were used to check the completeness. Complete data, and then analyzed the data using computer statistics, using software analyze various data as follows.

1. Descriptive Statistics: frequency, percentage, description of basic information
2. Inferential Statistics used Chi-square Test statistics to analyze the relationship of variables and Multiple linear regression statistics. Predict the risk factors for coliform bacteria contamination of food sold on stalls in Raman District, Yala Province. The level of statistical significance of the tests is determined at 0.05.

### Results

The study of risk factors for coliform bacteria contamination of food sold on stalls in Raman district, Yala province, the study presented the analysis results of this study into.

### General information of samples

**Table 1** Number and Percentage of Samples by General Information

General Information	Number (Person) ( n = 150)	Percent
1. Sex		
male	22	14.70
female	128	85.30
2. Age		
under 30 years	12	8.00
31-40 years	45	30.00
41-50 years	42	28.00
51-60 years	45	30.00
more than 60 years	6	4.00
3. Education level		
uneducated	4	2.70
primary school	75	50.00
secondary education	60	40.00

diploma / High Vocational	10	6.70
bachelor	1	0.70
4. Status		
dealer	24	16.00
cook	126	84.00
5. Ever trained in food sanitation.		
not trained	71	47.30
pass training	79	52.70

Table 1 showed the number and percentage of the sample classified by general information of entrepreneurs, found that most entrepreneurs were female 85.30%, males 14.70%, most age was between 31-40 years and 51-60 years with the same amount of 30 percent, followed by 41-50 years of age, 28 percent under the age of 30 percent, 8 percent and over 60 years of age, respectively. Most of them graduated with primary education at 50 percent, followed by secondary education at 40 percent, diploma levels at 6.70 percent, un-educated 2.70 percent and undergraduate at 0.7 percent respectively. Most of the respondents were 84.00% of cooks themselves, 16.00 % were suppliers, most of them didn't pass the training, 52.70% and 47.30% trained.

### Food retailer

**Table 2** Number and Percentage of Results of Food Inspection Locations

Criteria for Inspecting the Place of Sale	Past		Fail		$\bar{X}$	S.D.
	Number	Percent	Number	Percent		
1. Not less than 100 meters away from areas that may be hazardous to health or toilets	149	99.3	1	0.7	0.99	0.81
2. The panel is made of strong materials. no cracks, not damaged	134	89.3	16	10.7	0.89	0.30
3. Clean food stall no dust, soot, cobweb	129	88.0	21	14.0	0.86	0.34
4. Distribution boards at least 60 cm above the floor	150	100.0	0	0	1.00	0.00
5. There was protection against insects. and disease-causing animals.	123	82.0	27	18.0	0.82	0.38

Table 2 shows the number and percentage of the results of the 5 food distribution places. Most of the criteria that pass the most 100.00 percent are item 4. The panel sells at least 60 cm above the floor, followed by 1 Stay away from areas that are likely to be hazardous to health or toilets not less than 100 meters through 99.30 percent. 2 The panel was made of strong materials. 3 It was no cracks 89.30 percent, 4 were not damaged through the food distribution panels clean, no dust soot cobalt through 88.00 percent, respectively, and the least pass criteria was 5 There were 82.0 percent protection against insects and animals.

**Food distribution****Table 3 Number and Percentage of Results of Food Distribution**

Criteria for Food Distribution	Past		fail		$\bar{X}$	S.D.
	number	percent	number	percent		
1. Cooked food that was concealed or protected against animals, insects, or diseases.	135	90.00	15	10.00	0.90	0.30
2. Food additives must had a food recipe registration number (FDA).	150	100	0	0	1.00	0.00
3. Drinking water must be clean, clear water in a clean, concealed container, with a tap or pouring water.	106	70.67	44	29.33	0.70	0.45
4. Beverage must be put in a clean, concealed container, and had a scoop, a long handle, or a tap or a way to pour water.	110	73.33	40	26.67	0.73	0.44
5. Ice used for consumption must be clean and kept in a container with a lid at least 60 cm above the floor. The ice scoop had a long handle and does not put other food in the ice.	103	68.70	47	31.30	0.68	0.46
6. Rinsed the container with detergent and then wash the water 2 times or washed with running water. And washed equipment must be 60 centimeters above the floor.	105	70.00	45	30.00	0.70	0.45
7. Spoon, chopsticks, chopsticks set, put the handle in an airy container or in a clean airy container. And concealed Keep high from the floor at least 60 centimeters.	97	64.67	53	35.33	0.64	0.47
8. Food waste is collected for disposal	95	63.33	55	36.67	0.63	0.48

Table 3 showed the number and percentage of the inspection of all food sales characteristics 8 conclusion the most valuable part 2 . Food additives must had a food recipe registration number (FDA) over 100 percent. It was followed by item 1 cooked food with concealment or protection from animals, insects through 90.00 percent. Beverage must be put in a clean, concealed container. And had a scoop with a long handle or with a tap or a way to pour water through 73.33 percent. Drinking water must be clean water, put in a clean, concealed container, tap or pour the way through 70.67% of the water. It was rinsed the container with dishwashing liquid and then wash with clean water twice or wash with running water and the washing equipment must be 60 centimeters above the floor, 70.00 percent through. Ice consumption must be clean and kept in a container with a lid at least 60 cm above the floor. The ice scoop had a long handle and 68.7% didn't put other food in the ice, spoon, chopsticks, chopsticks set, put the handle in an airy container or in a clean airy container. It was concealed keep at least 60 centimeters off the floor at least 64.67 percent. The least passed criteria is item 8 food waste was collected for disposal in 63.33%.

**Personal Hygiene****Table 4** Number and Percentage of Personal Hygiene Examination Results

Personal Hygiene Examination Criteria	Past		fail		$\bar{X}$	S.D.
	number	percent	number	percent		
1. Wear clean clothes with sleeves, wear shoes covering the heel	141	94	9	6	0.94	0.23
2. Food touched wash their hands thoroughly before preparing to assemble food.	147	98	3	2	0.98	0.14
3. Used the device to handle the food that has been cooked.	150	100	0	0	1.00	0.00
4. Did not smoke while working on food.	150	100	0	0	1.00	0.00
5. All food touched must be healthy non-contagious must check the health.	150	100	0	0	1.00	0.00
6. Food contact cut short nails and always clean, did not paint nails, did not put jewelry on fingers and wrists	111	74	39	26	0.74	0.44
7. Food contact with a wound on the hand must covered the wound. And put on another layer of gloves.	143	95.3	7	4.7	0.95	0.21

Table 4 showed the number and percentage of the results of the 7 personal hygiene tests. It was found that most of the items that pass the most criteria 100% had 3 items, which were 3, items 3 used equipment to pick up the cooked food, item 4 did not smoke while working on food, and items 5 all food touches must be healthy. Non contagious must check the health. Followed by item 2, food contactors washed their hands thoroughly before preparing to assemble, cook 98.00% Food contestants with wounds on their hands have to cover up the wound successfully. It was wearing another layer of gloves, completely passing through 95.30 percent. It was wearing clean clothes with sleeves, wearing heeled shoes through 94.00%. The least passed criteria were item 6 food and nail cutters, always short and clean, no nails painted, no jewelry on the fingers and wrists passed the criteria 74.0%.

**Results of Detection of Coliform Bacteria in Hands, Containers and Food****Table 5** Number and Percentage of Results for Coliform Bacteria Detection in Food, Containers, and Households

Sample	Not Contaminated		Contaminated		$\bar{X}$	S.D.
	Number	Percent	Number	Percent		
Food	37	24.7	113	75.3	0.24	0.43
Food Container	100	66.7	50	33.3	0.66	0.47
Food Hand	103	68.7	47	31.3	0.66	0.46

Table 5 showed the number and percentage of results for the detection of coliform bacteria in food, utensils and hand touches, found that the food samples are contaminated at the highest level 75.30%. It was followed by coliform bacteria found in food containers, 33.30%. The least contamination was found in Coliform bacteria in the hand of the food contact, 31.30%.

### Summary of Stalls that Meet Sanitation Criteria

**Table 6** Number and Percentage of Stalls That Passed Sanitation Criteria

Food stall	Pass the Criteria (Not Contaminated)		Not Qualified (Contaminated)		$\bar{X}$	S.D.
	number	percent	number	percent		
Stalls that have been inspected.	23	15.30	127	84.70	1.15	0.36

Table 6 showed the number and percentage of good food stalls that have been examined by coliform bacteria. Found that there are 23 stalls that meet sanitation criteria, accounting for 15.30 percent. Stalls that did not meet the food sanitation criteria, there were 127 stalls, accounting for 84.70%.

### Study on Factors Affecting Coliform Bacteria in Food

#### 1. Factors concerning passing food sanitation training

**Table 7:** Training Factors of The Sample Group That were Related to Coliform Bacteria Contamination in Food

pass training	Coliform Bacteria Contamination				$\chi^2$	Df	Sig.
	Contaminated		Not Contaminated				
	number	percent	number	percent			
Not trained	68	45.33	3	2.00	12.813	1	.00*
pass training	59	39.33	20	13.33			

$P < 0.01$ , Contingency Coefficient .281

Table 7 the results showed that the proportion of untrained samples were the most contaminated 45.33%. 39.33% were trained with coliform bacteria contamination. 13.33% were trained without being contaminated with coliform bacteria. It was not trained, not contaminated with coliform bacteria 2.00%. Correlation testing found that training passed correlated with coliform bacteria contamination with statistical significance of 0.05 Contingency Coefficient .281, which has a relatively low relative size or 28 percent.

#### 2. Factors regarding food selling places

**Table 8** Food Supply Factors of The Sample Group That were Related to Coliform Bacteria Contamination in Food

Factors Concerning Food Selling Places	Coliform Bacteria Contamination				$\chi^2$	Df	Sig.
	Contaminated		Not Contaminated				
	Number	Percent	Number	Percent			
pass training	82	54.67	19	12.67	2.882	1	0.09

Not trained	45	30.00	4	2.67
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Table 8 the results of the study showed that the proportion of samples that passed the criteria for food distribution places is contaminated with coliform bacteria the most, 54.67%. Next, it did not meet the criteria for food distribution, 30.00% were contaminated with coliform bacteria. It was qualified for food distribution, 12.67% without coliform bacteria. It failed to meet the criteria for food distribution, not contaminated with coliform bacteria 2.67 percent. The relationship tests showed that factors relating to food distribution places were not correlated with coliform bacteria contamination in food.

### 3. Factors relating to food distribution

**Table 9:** Factors Relating to the Distribution of Food: Sample Groups That are Related to Coliform Bacteria Contamination in Food

Factors Regarding Food Distribution Characteristics	Coliform Bacteria Contamination				$\chi^2$	Df	Sig.
	Contaminated		Not Contaminated				
	Number	Percent	Number	Percent			
pass training	37	29.13	7	30.43	13.932	1	.001*
Not trained	90	70.87	16	69.57			

$P < 0.01$ , Contingency Coefficient .292

Table 9, the results showed that the proportion of samples that did not meet the criteria for distribution of food is contaminated with coliform bacteria the most, 70.87%. It passed the criteria for distribution of food that was not contaminated 69.57 percent. It qualified for food distribution, 30.43% non-contaminated coliform bacteria and meet the criteria for distribution of food, 29.13 percent were contaminated with coliform bacteria. Test relationship, it was found that the factors of food distribution characteristics of the sample group were significantly correlated with coliform bacteria 0.05.contingency coefficient .292 which has a relatively low relationship size or 29%.

### 4. Personal hygiene factors

**Table 10** Personal Hygiene Factors of The Sample Group That are Related to Coliform Bacteria Contamination in Food

Personal Hygiene Factors	Coliform Bacteria Contamination				$\chi^2$	Df	Sig.
	Contaminated Number	Contaminated Percent	Not Contaminated Number	Not Contaminated Percent			
pass training	87	58.00	15	10.00	.097	1	.756
Not trained	40	26.67	8	5.33			

Table 10 the results of the study showed that the proportion of samples that passed the personal hygiene criteria was the most contaminated with coliform bacteria 58.00%. It did not passed personal hygiene criteria, 26.67% were contaminated with coliform bacteria. Personal hygiene criteria, not contaminated with Coliform Bacteria, 10%. Correlation testing showed that hygiene factors were not a risk factor for coliform bacteria contamination. Statistical results showed that personal hygiene factors of the samples were not related to coliform bacteria contamination in food.



**Risk Analysis for Coliform Bacteria Contamination in food****Table 11** Risk Factors for Coliform Bacteria in Food

Factor	B	$\beta$	t	Sig.	RR	OR
Food sanitation training	.223	.310	4.112	0.001*	1.282	7.684
Food retailer	-.026	-	-.397	.692	1.131	2.607
		.033				
Food distribution	.256	.340	4.001	0.001*	1.329	5.560
Personal hygiene	-.026	-	-.437	.663	.977	.862
		.033				

Table 11, the results of multiple linear regression analysis to predict predictive relationships among variables found that food sanitation training can predict coliform bacteria contamination with Coefficient Regression, standard was equal to 310 ( $\beta = .310, p < .01$ ) with statistical significance. Food sanitation training could predict 31% of coliform bacteria contamination. When considering the risk, it was found that those who did not pass the training were 1.282 times more at risk of being infected with coliform bacteria (Relative risk = 1.282). Food distribution characteristics can predict coliform bacteria contamination with the coefficient  $\beta$  standard regression equal to 340 ( $\beta = .340, p < .01$ ) with statistical significance. That was to say, the nature of food distribution can predict 34% of coliform bacteria contamination. Considering the risk, it was found that the samples that did not meet the criteria for selling food are at a higher risk of being contaminated with coliform bacteria than those who meet the criteria for selling food at 1.329 times (Relative risk = 1.329).

**Discussion**

General information of the sample found that most of the entrepreneurs were female, 85.30% of the age were mostly between 31-40 years old and 51-60 years, the same amount was 30.00%, in line with the study of Daranee Kaewjumpol (2008) that studied the subject factors affecting Coliform Bacterial contamination of Bag Food Sold in category 1a case study of Nong Khai province, where the majority of the population was female than males of which 95.20 percent were female. This was consistent with the study of Pasit Plaeng Sor (2011) which studied the subject of Coliform Bacteria contamination in food stall in Ban Sang District Prachinburi most of the age groups were 30-40 years old and 41-50 years old are equal to 35.70%. Regarding knowledge, most of the trainees fail to pass the training, 52.70% and 47.30% complete, in line with the study of Wanwimon Malamkham (2007) that studies factors affecting food safety practices of Housewives in Kutsim Municipality, Khao Wong district, Kalasin province, found that housewives had only 42.5% of food safety knowledge. Correlation testing found that the trained sample had a significant correlation with coliform bacteria contamination, 0.05, with those trained in food sanitation having coliform contamination. Less bacteria than those without the food sanitation training concluded that knowledge or training is one factor that can reduce contamination. Knowledgeable people will pay attention to cleanliness and vigilance regarding food contact to reduce contamination, in line with Suphang in Yod's study (2016) that studied knowledge, attitude and food sanitation practices and the relationship between personal factors and knowledge, attitudes and practices regarding food sanitation. The knowledge was related to the food sanitation practice with statistical significance at the level of 0.05.

According to the sanitation regulations, food stalls should not be less than 60 centimeters. According to the survey, all food stalls have passed the criteria of food distribution. 100% because there will be health officials inspecting the panels every 6 months, which the stalls will constantly update the panels to meet standards the least passed criteria were 82.0% had protection against insects and disease animals, which is consistent with the study of Daranee Kaewjumpol (2008) which studied about factors affecting coliform bacteria contamination of bag food sold in type 1 markets: a case study of Nong Khai province which most panels do not have insect repellent devices, 61.9 percent. It can be seen that entrepreneurs are not

aware of the prevention and elimination of flies. There should be encouragement for operators to be aware of the importance of preventing insects and disease animals. This is consistent with the study of Pasit Plaeng Sor (2011) which studies the subject of Coliform bacteria contamination in food stall in Ban Sang District Prachinburi province, found that most entrepreneurs do not have a place to sell to prevent insects and diseases. Often use a swatter or glue to trap insects from such actions as a defense at the end of the cause only. From the correlation testing, it was found that those who passed the criteria for food distribution were more contaminated with coliforms than those who did not pass the food selling criteria. Food establishments that do not have a relationship with coliform bacteria contamination are not consistent with Chailert's studies. Kingkaew Chareonchai (2008), Which studied the factors affecting the contamination of bag food sold in type 1 market (case study of bag food sold in Type 1 market of 4 provinces). Type 1 in the municipality of 4 provinces which are Nan, Ang Thong, Nong Khai and Ranong provinces, it is found that food selling places have a correlation with the statistical significance of 0.05, but Consistent with the marshal glass vessel factors affecting contaminated with coliform bacteria bags of food sold in the market at 1 case study of offense at that. The food distribution places were not associated with coliform bacteria.

Regarding the characteristics of food distribution, it was found that most of them did not meet the criteria for food distribution and 83.46 percent of the contamination, when considered by most criteria, does not collect food waste for disposal which results in contamination easily the accumulation of fresh food waste and waste results in flies coming to be a breeding ground for animals, insects and germs, as well as the criteria for food distribution places where most do not have a fly repellent device, causing the nature of food distribution to be contaminated. The relationship test showed that the distribution of food was related to the coliform bacteria contamination with the statistically significance at 0.05.

Personal hygiene factors, found that most of them passed personal hygiene 68.00 percent. When considering the criteria that most of the respondents are Muslims wearing hijab which prevents part of the hair from falling out. The food and water sanitation division, Department of Health has stipulated that food contactors must gather hair or have a net or a hood to protect hair from falling into food. Hand picking and food handling equipment in accordance with the results of the study found that it was not contaminated with 75.30 percent of Coliform bacteria, because most entrepreneurs wash their hands every time with the hospital has allowed the health volunteers in the area to campaign for washing hands every time according to the policy of eating hot spoons, washing hands of the Ministry of Public Health.

The results of the sampling of hands, containers and food found that food samples are contaminated the most, 68.7% are not contaminated, 31.30% which is lower than the standard criteria of the Department of Health is the food inspected must pass 70% in accordance with Suthon Khiewkom (2014) who has studied the food sanitation situation of Ramadan food stall in Pattani municipality. When classifying the contamination, it was found that the most contaminated food or side dishes were as much as a percentage. 77.4 Complies with the Chailert's education Kingkaew Chareonchai (2008) studied the factors that cause the contamination of food bags sold in the 1st type market of 4 provinces such as Nan, Angthong, Nong Khai and Ranong provinces. The results of the samples were related to the contamination with statistical significance at the level of .05 and in accordance with Daranee Kaewjumpol (2007) that studied the factors affecting coliform bacteria contamination of bag food sold in type 1 market: a case study of Nong Khai area that found that the type of samples being examined is closely related to coliform bacteria contamination significant at 0.05 and 0.03.

Factors related to Coliform Bacterial contamination the factors studied in this study were training, food sales locations, food distribution, personal hygiene and the results of the examination of coliform bacteria in the samples found that there was 3 factors that was related to coliform bacteria contamination, namely the training of operators by operators. Those who received food sanitation training were less contaminated with coliform bacteria than those without food sanitation training. Knowledge or training is

one factor that can reduce contamination. Knowledgeable people will pay attention to cleanliness and monitoring about food contact to reduce contamination, in line with the Supang In Yod (2016) that studied the level of knowledge, attitudes and practices regarding food sanitation. And it was the relationship between personal factors and knowledge, attitudes and practices regarding food sanitation. The knowledge was related to the food sanitation practice with statistical significance at the level of 0.05 but not consistent with Daranee Kaewjumpol who studied the factors affecting coliform bacteria contamination of bagged food sold in the market. Type a case study of Nong Khai area that was found received training is not associated with contamination.

The characteristics of selling food can be seen that the most passed item, up to 100 percent, was food additive, must have food recipe registration number (FDA). From the above clause, it can be seen that entrepreneurs have knowledge of buying principles. the labeling that meets the FDA standards was consistent with the research by Manakarn Yangsuk (2002). The knowledge and practice in accordance with the food sanitation principles of the hospitals in the Ramkhamhaeng network in the north, found that knowledge in the purchase of raw materials was very good and consistent with the studies of Chai Lert Kingkaew Chareonchai and the team studied the factors that cause the contamination of bag food sold in the 1st type market of 4 provinces, namely Nan province, Ang Thong, Nong Khai and Ranong. The distribution of food was correlated with contamination at the statistical significance level of .05.

The results of the coliform bacteria contamination in the samples showed that the samples examined had a significant correlation with coliform bacteria at .05 which was consistent with the study of Udom Worawor. The study of the food sanitation situation in a community hospital in Sakon Nakhon province found that the testing of the relationship between the food sanitation condition and the result of the inspection the bacteria found in food containers beyond. less than the standard (72.5% and 27.5% respectively) found that there was a statistical relationship ( $p < 0.05$ ). Risk analysis for coliform bacteria contamination in food the results of the analysis with multiple linear regression to predict relationships among variables found that food sanitation training could predict coliform bacteria contamination with the coefficient standard regression equal to 310 ( $\beta = .310$ ,  $p < .05$ ) with statistical significance, that was to say food sanitation training could predict 31% of coliform bacteria contamination. When considering the risk, it was found that those who did not pass the training were more at risk of coliform bacteria than those who passed. 1.282 times training (Relative risk = 1.282). Food distribution characteristics predicted coliform bacteria contamination with coefficient standard regression was. 340 ( $\beta = .340$ ,  $p < .05$ ) with statistical significance. Food distribution characteristics predicted 34% of coliform bacteria contamination. When considering the risk, it was found that those who do not pass the food distribution criteria are at higher risk of coliform bacteria contamination than those who meets the criteria for selling food 1.329 times (Relative risk = 1.329).

## Conclusion

Most of the entrepreneurs were 85.30% female, 14.70% male, the majority were between 31-40 years old and 51-60 years old with the same amount which was 30%, followed by 41-50 years old 28%, under 30 years 8% and over 60 years of age 4% respectively. Most of them graduated with primary education at 50 percent, followed by secondary education at 40 percent, diploma / 6.70 percent have not received 2.70 percent education, and 0.7 percent at bachelor degrees respectively. Most of the respondents were 84.00%, cook themselves. 16% of the distributors were trained, most of them do not pass the training 52.70% and 47.30% trained.

There are 5 food distribution places that pass the most, 100.00%, which is item 4. The panel is at least 60 cm above the floor. It followed by item 1 stay away from areas that may be harmful to health or toilet not less than 100 meters through 99.30 percent. The panel was made of strong materials. No cracks, no damage, 89.30 percent pass through, clean food stall without dust, soot, algae, passed 88.00 percent. The least passed criteria was item 5, 82.0% had protection from insects and diseases. Proportion of samples

that passed the criteria for food distribution places were contaminated with coliform bacteria the most, 54.67%. It failed to meet the criteria for food distribution, 30.00% were contaminated with coliform bacteria. It qualified for food distribution, 12.67% without coliform bacteria. It failed to meet the criteria for food distribution, not contaminated with coliform bacteria 2.67 percent. The relationship tests showed that factors relating to food distribution places were not correlated with coliform bacteria contamination in food.

There are 8 criteria for selling food. Most of the criteria that passed the most are food 2. Food additives must had food recipe registration number. (FDA) passed 100 percent. Article 1: Cooked food is concealed or are protected against animals, insects or diseases through 88.70%. Beverage must be put in a clean, concealed container. And had a scoop with a long handle or with a tap or a way to pour water through 72.00 percent. It rinsed the container with dishwashing liquid and then washed with clean water twice or washed with running water and washing equipment must be 60 centimeters above the floor through 68.70 percent. Ice consumption must be clean and kept in a container with a lid at least 60 cm above the floor. The ice scoop had a long handle and did not allow other food to be immersed in the ice through 65.30%. Drinking water must be clean water. It was transparent in a clean, concealed container with a tap or a path to pour water through 63.30 percent. Spoon, chopsticks, chopsticks set up, put the handle in a clean, airy container, or placed in an airy, clean and concealed container keep at least 60 centimeters off the floor, 60.70 percent. The least passed criteria was item 8, 59.3% of food waste were collected for disposal. The proportion of samples that did not pass the criteria for distribution of food was contaminated with coliform bacteria the most, 83.46%, followed by 52.17% of uncontaminated food distribution. It failed to meet food distribution criteria, 47.83 percent were not contaminated with coliform bacteria and 16.54 percent were contaminated with coliform bacteria, respectively. Correlation testing found that the factors of food distribution characteristics of the samples relate to coliform bacteria contamination with statistical significance of 0.05 Contingency Coefficient .296 which has a relatively low relative size or 29 percent.

Personal hygiene criteria, 7 items, found that most of the criteria that passed the most 100 percent are 3 items, item 3 uses a device to pick up the food that has been cooked, clause 4 did not smoke while working on food and article 5, all food touches must be healthy non-contagious must check the health. Personal hygiene criteria, 7 items, found that most of the criteria that passed the most 100 percent are 3 items, item 3 uses a device to pick up the food that has been cooked, clause 4 did not smoke while working on food, and article 5, all food touches must be healthy non-contagious must check the health. The least passed criteria were item 6, food contact, cut short and clean nails, did not paint nails, did not put jewelry on fingers and wrists passed the criteria 74.00 percent. The proportion of samples that passed the personal hygiene criteria was the most contaminated with coliform bacteria 58.00%. It did not pass personal hygiene criteria, 26.67% were contaminated with coliform bacteria. Personal hygiene criteria were not contaminated with Coliform Bacteria 10 percent and personal hygiene criteria were not contaminated with Coliform bacteria 5.33 percent respectively. Correlation testing showed that personal hygiene factors of the samples were not correlated with coliform bacteria contamination in food.

The results of coliform bacteria testing in food, utensils and hand contact revealed that 75.30% of the samples were contaminated. Coliform bacteria were found in food containers at 33.30 percent and found coliform bacteria in the hands of the food touches at the least 31.30 percent. Food samples were contaminated with coliform bacteria the most, 68.70%, followed by food containers contaminated with 66.70%, and the hand that was contaminated food contact it was the least 24.70%. When testing relationships the hand of the food contact had a significant correlation with coliform bacteria. 0.05 Contingency Coefficient .597, that moderate relationship size or 59%. Food container Correlated with coliform bacteria at the statistical significance of 0.05 Contingency Coefficient .288, which had a relatively low relative size or 28 percent. Food samples were significantly correlated with coliform bacteria 0.05 Contingency Coefficient .276 which has a relatively low relative size or 27 percent.

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