Analysis of Gastroenteritis Incidence during the Covid-19 Pandemic on Shopping Center Employees

Veniranda Neny Widyastuti
Student of the Master's Program in Public Health Sciences, Faculty of Public Health
Universitas Sriwijaya
Palembang, South Sumatera, Indonesia
venimadiun@gmail.com

Hermansyah and Yuanita Windusari
Lecturer of the Master's Program in Public Health Sciences, Faculty of Public Health
Universitas Sriwijaya
Palembang, South Sumatera, Indonesia
venirandawidyastuti@yahoo.co.id, ywindusari@yahoo.com

Abstract

Shopping centers as a public facility where people gather to carry out various activities can become a cluster of Covid-19 transmission. During the SARS-CoV-2 pandemic, most of our attention was focused on the symptoms of respiratory distress. Meanwhile, we cannot rule out the symptoms of diarrhea and other digestive tract disorders, such as gastroenteritis which is characterized by complaints of bowel syndrome. This study was an analytic study with a cross-sectional design. The research subjects were 208 employees at 5 malls in Palembang and 12 restaurants that were the employees' choice for lunch. The bivariate analysis showed that all variables in the restaurant sanitation hygiene assessment were related to the number of complaints of Irritable Bowel Syndrome (IBS). The biggest factors causing foodborne illness (gastroenteritis) in shopping center employees are food processing (PR =3,618), restaurant location (PR = 3,409), and restaurant door variables (PR =3,409). Shopping centers, where often people gather not only to buy necessities but also to have fun, need to be more paid attention to, among others, through the personal hygiene of its employees, which can be started from restaurant choices and cooking menus so that they do not become a new cluster in the spread of Covid-19.

Keywords
Gastroenteritis, Shopping Center, Palembang, Covid-19

1. Introduction
Gastroenteritis is defined as vomiting and Diarrhea Syndrome or a combination of both. (Getto et al. 2011) The symptoms of vomiting and diarrhea need to be considered because clinically they are symptoms of gastroenteritis. Gastroenteritis in adults caused by Calicivirus often causes epidemic events. (Wilhelmi et al. 2003) Another cause of gastroenteritis is Salmonella bacteria. (Majowicz et al. 2010) Apart from Salmonella, other bacteria that cause digestive disorders are Escherichia Coli O157: H7. Since 1982, this bacterium is known to be the main cause of pathogenicity in the food industry. (Pala et al. 2010) The presence of E. Coli is closely related to sanitation facilities, which are equipment that must be available to maintain environmental quality so as to prevent pollution, in this case, food contamination. The sanitation facilities in question are the availability of clean water, waste management, wastewater management, clean toilets, hand washing facilities, and equipment. (Kurniadi et al. 2013). The availability of water that meets health requirements greatly affects the final results of food products because water is needed in every stage of the processing process and washing equipment. (Nuryani et al. 2016) Bacteria or digestive germs can cause secondary infections due to a combination of genetic viruses. Likewise, the virulence and secondary frequency, such as poliovirus, reovirus, and norovirus can also be increased due to the presence of digestive bacteria (Erickson et al. 2018).

From January 19 to February 9, 2020, in the city of Wenzhou, China, 7 shopping center staff were detected and 10 visitors tested positive for COVID-19. (Cai et al. 2020) The closest contacts of these patients were traced and found

11 other people who also tested positive for infection. Until now, it has not been proven that the virus can live outside the human body, but seeing the experience of the outbreak of the Middle East Respiratory Syndrome (MERS) case, the coronavirus is viable and infectious for 60 minutes from the time it is exhaled (aerosolization). Based on this experience, it is suspected that there was indirect transmission through door handles, elevator buttons, and handrails on the elevator stairs. (8) During the SARS-CoV-2 pandemic, most of our attention was focused on the symptoms of respiratory distress. Meanwhile, we cannot avoid the fact that a significant number of COVID-19 patients also experience symptoms of diarrhea. (7) Symptoms of diarrhea should be a concern of SARS-CoV-2 infection and should be followed up as an initial diagnosis of COVID 19. (7)

Specific objective to be achieved in this research are to analyze the quality of sanitation hygiene for food processing facilities, namely restaurants, canteens, or food stalls where shopping center employees have lunch based on the following inspection variables: location and building, sanitary facilities, kitchen, dining room, and grocery store, food ingredients, and finished food, food processing, food storage, and prepared food, serving of food, utensils, labor

2. Literature Review

2.1 Food Sanitation Hygiene
Everyone has the right to receive food that is safe and fit for consumption. (Shariatifar 2017) Diseases caused by food poisoning are very detrimental and can even be fatal. Every party involved in the business of providing food, from farmers to food handlers and consumers, is also responsible for preventing foodborne diseases. Therefore, food sanitation hygiene supervision must be carried out properly. The principle of food sanitation hygiene or better known as Hazard Analysis Critical and Control Points (HACCP) is a program to monitor food supply to ensure food is safe for consumption. This program can be applied to a whole series of food supply systems from agriculture to food presentation (from farm to Table) based on scientific evidence. In many developing countries, HACCP principles are often poorly implemented, increasing the risk of developing foodborne illnesses. (Shariatifar 2017)

To implement HACCP properly and correctly, it is necessary to precede the implementation of Sanitation Standard Operating Procedures (SSOPs), namely by recording and implementing each stage of the process on a report document or checklist. Every worker must understand each of these stages and be able to carry them out effectively. The successful implementation of HACPP can be achieved if SSOPs are carried out and well documented. The implementation of SSOPs can also prevent the occurrence of excess workload experienced by employees because each individual has their respective responsibilities. (Mekonen et al. 2014) The implementation of SSOPs is a series of standardized routine sanitation activities, for example how to store food, how to maintain the temperature of food storage, clean equipment including cleaning schedules, cleanliness of food handlers including completeness of work clothes, and handwashing habits. The steps in SSOPs are stated in a document that is done as a team or group by providing input in accordance with their field of knowledge. The execution of each step must also involve a time frame so that it can be well scheduled.

2.2 Definition of Gastroenteritis
Gastroenteritis is a digestive disorder characterized by vomiting or diarrhea in which the patient experiences watery bowel movements more than twice a day. People sometimes refer to it as stomach flu (Children et al. 2020) Apart from indigestion, this infection can also be accompanied by fever, headache, muscle aches, reduced appetite, and weight loss. In elderly people, this disease can show quite severe symptoms such as vomiting blood, being unable to swallow fluids so that they vomit again, to defecate accompanied by blood. In this condition, a doctor's help must be given immediately. Whereas in infants or toddlers, this disease can cause symptoms of lethargy, high fever, uncomfortable feelings so that the child becomes fussy, dehydrated, cries without tears and has a dry mouth.

One of the causes of gastroenteritis is a virus. Until the 1940s, the type of virus that caused it was not widely known. Then in 1972, Kapikian et al first identified the presence of the Norwalk virus in the feces of a patient with gastroenteritis. The following year rotavirus was discovered by Bishop et al. (Wilhelmi et al. 2003) and in 1975 astrovirus and enteric adenovirus were also found in children with acute sufferers. Since then, the types of viruses associated with gastroenteritis have been increasingly known, including coronavirus, picobirnavirus, pestivirus, and torovirus. (Wilhelmi et al. 2003) Treatment of viral gastroenteritis is symptomatic in which the main goal is to prevent secondary dehydration. (Wilhelmi et al. 2003) Therefore, first aid with fluids is very important to overcome the lack of fluids and replace the loss of body fluids due to vomiting and diarrhea.

Another cause of gastroenteritis is bacteria, especially Salmonella bacteria. As published by The Center for Disease Control periodically about food poisoning outbreaks, that in 1973 there were a total of 307 food poisoning outbreaks that affected 12,447 people and resulted in 15 deaths. the person in between. Seven of the deaths were due to salmonellosis, four of which were botulinum, one due to Clostridium perfingens, one from trichinosis, and two other non-infectious consequences. The cause of the 66% outbreak was bacteria with the following details: Salmonella 26%, Staphylococcus aureus 15.6%, Clostridium perfingens7.1%, Shigella 6.3%, Bacillus cereus 0.8%, Brucella melitensis 0.8%, Group A Streptococcus 0.8%, Vibrio parahaemolyticus 0.8%, Trichinella spiralis 7.9%, and Hepatitis A 3.9%. E. coli bacteria can also be a cause of acute diarrhea, both in adults, cholera.

2.3 Factors Causing Gastroenteritis

There are several research results on the topic of school canteen sanitation hygiene which focuses on different aspects. One of them is a study of a case of food poisoning at a high school in Brooklyn, United States in 1984. (Guest et al. 1987) In this study, investigations were carried out which included sanitary inspections of school canteen facilities, laboratory examinations of food samples, interviews with food handlers. and distributing questionnaires to students. Sanitary inspections found that chicken and tuna salad were stored at 160°C and cooked hamburgers were kept at 430°C. Supposedly, storage of cooked food (ready to eat) should be done at temperatures below 70°C or above 600°C. In addition, in the results of the interview, it was found that there were two canteen workers who experienced indigestion but on the day of the extraordinary event, food poisoning continued to work processing food as usual. Research in Spain published in 2012 focused on providing salad or raw vegetables. Raw vegetables that are defined as ready to eat (RTE) vegetables are often treated inappropriately so that their nutritional function decreases rapidly. (Rodríguez-Caturla et al. 2012) This treatment includes storage at too hot temperatures, unhygienic behavior of food handlers, and air circulation systems that can cause cross-contamination, either from visitors, food handlers, or from the vegetables themselves. Handlers' behavior is a major concern related to wearing gloves and whether they wash their hands often or not. It is further recommended that frequent hand washing is preferable to using gloves that are changed rarely.

Meanwhile in Bali Province, (Nuryani et al. 2016) processed food samples were taken from canteens, stalls, and restaurants in 2013. Of the 29 samples, 25 were positively contaminated by E. coli bacteria. This finding was then followed up with research on 31 primary school canteens in the South Denpasar District from January to March 2015. The study was conducted with independent variables in the form of food selection, storage of food and processed food, food processing, food transportation, food serving, condition and sanitation of buildings, sanitary facilities and food handlers, and laboratory tests for dependent/ dependent variables. In addition, water samples were also taken to test for E. coli bacteria. From the results of data analysis, it is known that sanitation facilities play a dominant role in ensuring the quality of processed food products. The sanitation facilities in this study which include clean water availability, waste handling, wastewater handling, toilet hygiene, hand washing facilities must be able to control the factors of equipment, foodstuffs, places, and people in order to prevent poisoning, contamination, decay, and counterfeiting.

2.4 Irritable Bowel Syndrome as a Long-Term Impact of Bacterial Gastroenteritis

Irritable Bowel Syndrome (IBS), is defined as a digestive function disorder characterized by general symptoms of stomach upset without any specific pathological evidence. (Smith and Bayles 2007) Disorders that appear may include symptoms of diarrhea, dyspepsia, bloating, nausea, and early satiety. The main symptom is recurrent abdominal pain which affects the frequency of bowel movements and consistency of stool along with the disappearance of abdominal pain with the process of bowel movements. Other symptoms that appear can vary widely between individuals, so successful treatment requires a variety of individual-based strategies (Smith and Bayles 2007).

Acute bacterial gastroenteritis can be associated with the appearance of IBS symptoms and lead to another condition known as post-infectious IBS (PI-IBS). (Smith and Bayles 2007) An increase in PI-IBS can occur if the gastroenteritis suffered is severe enough and lasts a long time. In addition, the increase can occur due to the level of virulence of the bacteria, the sex of the patient (women have 2-3 times higher risk than men), and a person's mental condition, such as anxiety and depression. Recent studies of IBS and PI-IBS patients have also seen that inflammation of the intestinal mucus layer is accompanied by the appearance of immune-producing cells such as T cells and other natural killer cells. Symptoms of IBS can be monitored by asking several measurable questions known as the Rome Criteria. This

questionnaire is always updated and the most recent is The Rome IV Diagnostic Questionnaire for Functional Gastrointestinal Disorders in Adults (R4DQ). (Whitehead et al. 2017) However, this questionnaire is rarely used because it has a very complex list of questions that is difficult to remember. (Whitehead et al. 2017) A reliable and accurate questionnaire is needed that can separate gastrointestinal patients from other patients (Talley et al. 1990).

2.5 Shopping Center

A shopping center is not just a collection of shops that sell merchandise in retail. (Shariatifar 2017) In it, a unity of architectural design and site plan is illustrated. A parking area is also provided to support the smooth flow of visitors and the arrangement of the area is designed from a visitor's point of view to ensure service satisfaction. The types of goods and services offered in each tenant have been selected so that there is a balance and avoid uniformity. A shopping center is a center of economic activity involving entrepreneurs, tenants, owners of capital, and the surrounding community (Shariatifar 2017).

According to the Mayor of Palembang City Regulation number 25 of 2011 concerning Guidelines for the Arrangement and Development of Shopping Centers and Modern Stores, modern stores are shops that sell retail with an independent service system and can take the form of supermarkets, department stores. Hypermart is defined as a shopping center or shopping mall which consists of retail stores with the support of various facilities so that it becomes a unit to provide convenience for its visitors. (Sugianto and Setyowati 2012) Generally, retail stores are designed to face the main corridor as a center of visitor activity and circulation.

3. Methods

The design of this study was an analytic cross-sectional with observation. The study provides a descriptive description of the score of the restaurant hygiene sanitation assessment with the incidence of gastroenteritis which is characterized by the incidence of irritable bowel syndrome and the prevalence rate of gastroenteritis complaints based on the examination variables in restaurants, stalls, or canteens of choice for shopping center employees for lunch.

Shopping centers that are the population of the study are shopping malls with the category of community and regional centers, namely shopping centers that can accommodate visitors of up to 40,000-400,000 people with an area equal to or more than 10,000 m^2. In Palembang, there are 7 shopping centers that meet these criteria. Primary data were obtained from observations of the employee lunch reference stalls/ restaurants using the restaurant-grade form in accordance with the Decree of the Minister of Health No. 1098/ MENKES/ SK/ II/ 2003 regarding Sanitation Hygiene Requirements for Restaurants/ Restaurants and interviews with employees to determine the symptoms of gastroenteritis using Irritable Bowel Questionnaire. Hypothesis testing is done by logistic regression.

4. Data Collection

4.1 Hygiene Sanitation for Food Processing Places

Sanitation hygiene data for food processing places is obtained through observations of reference restaurants or lunch stalls for shopping center employees using a checklist or form RM.02 to score the following variables: location and building, sanitary facilities, kitchen, dining room, and grocery store, food ingredients and prepared food, food processing, food storage, and prepared food, serving of food, utensils, and labor.

4.2 Bacteriological Test

Data collection of food sample germ numbers is obtained through a bacteriological sampling of food from restaurants, stalls, or canteens that are lunch references for shopping center employees in Palembang City. In laboratory examination, 10 grams of samples are crushed and taken to be put into an Erlenmeyer flask. Furthermore, 90 ml of physiological saltwater or sterile aqua dest are added and shaken 25 times until homogeneous. Samples are ready to be planted on agar media and cultured in an incubator at 35°C for 24-48 hours with the petri dish upside down. The growing colonies were then counted using a colony counter.

4.3 Dependent Variable Data

The collection of data on the incidence of gastroenteritis was obtained by filling in the Irritable Bowel Syndrome Questionnaire form which was translated into Indonesian by the Sriwijaya University Language Institute for scoring according to the references in the original form. If the score is below 15, then the respondent does not experience symptoms of irritable bowel syndrome (IBS). If the score is 15-24, then the respondent has irritable bowel syndrome

(IBS) which is accompanied by other causes and if the score is 25-30, then the respondent is declared to have irritable bowel syndrome (IBS).

The number of samples of employees interviewed about gastroenteritis complaints was calculated using the formula from James Lemeshow as follows:

$$N = \frac{2[Z_{1-\alpha/2}\sqrt{2P_2(1-P_2)} + Z_{1-\beta}\sqrt{P_1(1-P_1)} + P_2(1-P_2)]}{(P_1-P_2)^2} \quad (1)$$

Which is :

N	=	Minimal sample size
$Z_{1-\alpha/2}$	=	Alpha raw derivate 5% = 1,96
$Z_{1-\beta}$	=	beta derivate standard strength test 80% = 1,64
P	=	(P1+P2) /2 = 0,4
P_1	=	Unqualified food serving with a positive E. coli is 50% or 0,5.
P_2	=	Serve of foods that qualify with a positive E. coli, is 33,3% or 0,3.

The total number of employees who became respondents was a total of 208 spread across 5 shopping centers because 2 shopping centers stated that employees did not consume lunch outside the office or bring their own from home. The largest number of respondents came from the E-Shopping Center, covering 25% of the entire sample.

5. Results and Discussion

5.1 Numerical Results
The frequency distribution of respondents in each shopping center can be seen in Table 1

Table 1. Distribution of research respondents based on shopping centers

Research Sites	Amount	
	N	%
Shopping center / mall A	41	19,7
Shopping center / mall B	25	12,0
Shopping center / mall C	45	21,6
Shopping center / mall D	45	21,6
Shopping center / mall E	52	25,0
Total	208	100

Every restaurant that is used as a reference for employees is subjected to observation and sanitation hygiene assessments using form RM.02. From the results of the total scoring, it is known that the grade or level of sanitation hygiene is in accordance with the provisions stipulated in the Decree of the Minister of Health No. 1098/2003 concerning Hygiene Requirements for Restaurant / Restaurant Sanitation. The results of the restaurant sanitation hygiene assessment can be seen in Table 2 below.

Table 2. The results of the sanitation hygiene assessment score for lunch referral restaurants for shopping center employees

No	Shopping Center Name	Restaurant Name	Score	Grade
1.	Shopping Center / mall A	PJY	260,5	Non Grade
		SK	495,5	Non Grade
		OG	433	Non Grade
2.	Shopping Center / mall B	CA	419	Non Grade
		PJ	373	Non Grade
3.	Shopping Center / mall C	LG	951,5	Grade A
		RB	842,5	Grade B
		PV	599	Non Grade
4.	Shopping Center / mall D	EP	368,5	Non Grade
		PJ II	441,5	Non Grade
		S	629	Non Grade
5.	Shopping Center / mall E	SM	492,5	Non Grade

From Table 2 it is known that most of the restaurants that are referred to by employees do not meet the minimum grade requirement for restaurants, which is a value of 700. Of the restaurants that were observed, only 2 or 16% of the restaurants met the requirements to get a restaurant-grade rating or restaurant.

Based on Table 2 above, the total score for the restaurant assessment shows that almost all restaurants have a score of <700 in the Non-Grade category, namely 10 restaurants (83.3%). Meanwhile, for the Grade A and B categories, only 1 restaurant was obtained with a percentage of 8.3%. The average restaurant has a total score of 467 with a minimum value of 260.5 and a maximum of 951.5. This means that there are still many restaurants that do not meet the sanitation hygiene requirements so that they do not deserve to be awarded the restaurant-grade predicate.
Furthermore, the distribution of the restaurant assessment score frequency can be seen in Table 3 below.

Table 3. Distribution of the restaurant assessment score frequency

Total Overall Restaurant Rating	n	%
900-1000 (Grade A)	1	8,3
800-899 (Grade B)	1	8,3
700-799 (Grade C)	0	0
< 700 (Non Grade)	10	83,3
Total	12	100
Mean	Median	Min-Max
525,4	467	260,5-951,5

In each shopping center, an assessment of the incidence of gastroenteritis is carried out through a list of questions contained in the IBS Questionnaire according to attachment 2. Symptoms of Irritable Bowel Syndrome (IBS) in question are symptoms experienced by respondents within a period of one year. To meet these criteria, the selected respondents are employees who have worked for at least one year. The results of the IBS symptom assessment can be seen in Table 4. below.

Table 4. Irritable Bowel Syndrome symptom assessment on shopping center employee

No	Shopping Center Name	IBS Symptom Rate
1.	Shopping Center/ mall A	0,634
2.	Shopping Center/ mall B	0,000
3.	Shopping Center/ mall C	0,000
4.	Shopping Center/ mall D	0,067
5.	Shopping Center/ mall E	0,038

From Table 4 it is known that the symptoms of Irritable Bowel Syndrome are mostly experienced by employees of shopping center A, while in shopping centers B and C there are no symptoms.

An overview of the prevalence ratio of location and building with foodborne diseases (gastroenteritis) is shown in Table 5 below. In detail, it can be seen that in a good location and building, there are 2 employees who suffer from gastroenteritis symptoms. Meanwhile, in bad locations and buildings, there were 29 employees who suffered from gastroenteritis, or equal to 33.7%.

Table 5. Prevalence ratio of location and building with foodborne diseases (gastroenteritis)

Location and Building	Gastroenteritis				Total		PR (95% CI)	p-value
	IBS		Not IBS					
	n	%	n	%	n	%		
Bad	29	33,7	57	66,3	86	100	0,674	0,000
Good	2	1,6	120	98,4	122	100	(0,579-0,785)	
Total	31	14.9	177	85.1	208	100		

Based on statistical tests, it is known that the PR value of 95% CI = 0.674 (0.579-0.785), meaning that a bad location and building reduces the risk of gastroenteritis by 0.674 (33% reduces the risk) and is statistically significant (p = 0.000).

The results of the analysis of the prevalence ratio of Sanitation Facilities as second variable and Kitchen, Dining Room, and Food Storage as third variable and the fifth variable which is Food Storage and Processed Food Storage foodborne diseases have the same results that can be seen as Table 6 below that good variable caused gastroenteritis symptoms in 5 employees or as much as 3.5%. Meanwhile, poor variable can cause gastroenteritis symptoms in 26 employees, or 39.4% of the respondents who chose restaurants with good sanitation facilities, 3.5% experienced gastroenteritis, while most of the others, 96.5% did not experience gastroenteritis. Based on the statistical test, it was known that the PR value was 95% CI = 0.628 (0.516-0.765), meaning that poor of those variables reduced the risk of gastroenteritis by 0.628 (38% reduced the risk) and was statistically significant (p = 0.000). Details can be seen in Table 6 below.

Table 6. Prevalence ratio of sanitation facilities /kitchen, dining room, and food storage /food storage and processed food storage and foodborne diseases (gastroenteritis)

Sanitation Facilities / Kitchen, Dining Room, and Food Storage/ Food Storage and Processed Food Storage	Gastroenteritis				Total		PR (95% CI)	p-value
	IBS		Not IBS					
	n	%	n	%	n	%		
Bad	26	39,4	40	60,6	66	100	0,628 (0,516-0,765)	0,000
Good	5	3,5	137	96,5	142	100		
Total	31	14.9	177	85.1	208	100		

An overview of the prevalence ratio of food ingredients and processed foods with foodborne diseases (gastroenteritis) can be seen in Table 7 below. The results of the analysis of the relationship between food ingredients and processed food with foodborne diseases showed that good food and processed food ingredients could cause gastroenteritis symptoms in 29 employees or 22.1%. Meanwhile, poor food and processed foods caused 2 or 2.6% of employees to experience gastroenteritis. The statistical test results obtained by the value of p = 0.000, it can be concluded that there is a difference in the proportion between food ingredients and processed food with the incidence of gastroenteritis in employees (there is a significant relationship between food raw ingredients and food processing with the incidence of gastroenteritis). Based on the statistical test, it was known that the PR value of 95% CI = 1.251 (0.516-0.765), meaning that poor food ingredients and processed foods increased 1.251 risks of gastroenteritis and were statistically significant (p = 0.000).

Table 7. Prevalence ratio of food raw ingredients with foodborne diseases

Food Raw Ingredients and Foods Processing	Gastroenteritis				Total		OR (95% CI)	p-value
	IBS		Not IBS					
	n	%	n	%	n	%		
Bad	2	2,6	75	97,4	77	100	1,251 (1,134 - 1,380)	0,000
Good	29	22,1	102	77,9	131	100		
Total	31	14,9	177	85,1	208	100		

The prevalence ratio of Food Processing as the fifth variable and Food Storage and Processed Food Storage as sixth variable and Foodborne Diseases (Gastroenteritis) have same results, which is the analysis of the relationship between those variables and foodborne diseases, it was found that good variables caused 2 (1.6%) incidents of gastroenteritis in employees. Meanwhile, poor variables caused 29 (33.7%) gastroenteritis in employees. The p-value = 0.000 indicates that there is a significant relationship between food processing and the incidence of gastroenteritis in employees (there is a significant relationship between food processing and the incidence of gastroenteritis). Based on statistical tests, it is known that the PR value of 95% CI = 0.674 (0.579 – 0.785), meaning that poor food processing reduces the risk of gastroenteritis by 0.674 (33% reduces the risk) and is statistically significant (p = 0.000). Table 8 showed it in detail.

Table 8. Prevalence ratio of food processing and foodborne diseases (gastroenteritis)

Food Processing/	Gastroenteritis				Total		PR (95% CI)	p-value
	IBS		Not IBS					
	n	%	n	%	n	%		
Bad	29	33,7	57	66,3	86	100	0,674	
Good	2	1,6	120	98,4	122	100	(0,579-0,785)	0,000
Total	31	14,9	177	85,1	208	100		

An overview of the prevalence ratio of food presentation and foodborne diseases (gastroenteritis) and the relationship between food utensils and foodborne diseases (gastroenteritis) can be seen in Table 9. Based on statistical tests, it was found that the PR value of 95% CI = 0.628 (0.516-0.765), meaning that poor food presentation and utensils reduced the risk of gastroenteritis 0.628 (38% reduced risk) and were statistically significant (p = 0.000).

Table 9. Prevalence ratio of food presentation and utensils with foodborne diseases (gastroenteritis)

Food Presentation /Utensils	Gastroenteritis				Total		PR (95% CI)	p than poor value
	IBS		Not IBS					
	n	%	n	%	n	%		
Bad	26	39,4	40	60,6	66	100	0,628 (0,516-0,765)	0,000
Good	5	3,5	137	96,5	142	100		
Total	31	14,9	177	85,1	208	100		

An overview of the prevalence ratio of labor and foodborne illness (gastroenteritis) can be seen in Table 10 below

Table 10. Prevalence ratio of labor and foodborne diseases (gastroenteritis)

Labor	Gastroenteritis				Total		OR (95% CI)	p-value
	IBS		Not IBS					
	n	%	n	%	n	%		
Bad	28	30,1	65	69,9	93	100	0,718	0,000
Good	3	2,6	112	97,4	177	85,1	(0,626-0,823)	
Total	31	14,9	177	85,1	208	100		

The results of the analysis of the prevalence ratio of labor and foodborne illness indicated that good labor caused gastroenteritis in 3 employees, while poor labor caused gastroenteritis in 28 (19%) of employees. From the statistical test results obtained by the value of p = 0.000, it can be concluded that there is a difference in the proportion between workers and the incidence of gastroenteritis in employees (there is a significant relationship between labor and the incidence of gastroenteritis). Based on statistical tests, it is known that the PR value of 95% CI = 0.718 (0.626-0.823), means that a poor workforce reduces the risk of gastroenteritis by 0.718 (28% reduces the risk) and is statistically significant (p = 0.000).

5.2 Multivariate Analysis of Sanitation Hygiene for Food Processing Sites

Based on Table 11, it can be concluded that of the 9 variables studied, only 3 variables met the requirements for entry into the multivariate analysis, where the variables consisted of location and building variables (*p-value*= 0.000); food processing (*p-value*= 0,000); and labor (*p-value*= 0.001.) Furthermore, the 3 variables will be analyzed multivariate to see which variable has the greatest influence on the incidence of gastroenteritis. In detail, the results of the analysis can be seen in Table 11.

Table 11. Selection of Bivariate Hygiene Sanitation for Food Processing Sites

Variable	p-value	State
Location and Building	0,000	Model entered
Sanitation Facilities	0,655	Model entered denied
Kitchen, Dining Room, and Food Storage	0,998	Model entered denied
Raw Ingredients and Processed Food	0,861	Model entered denied
Food Processing	0,000	Model entered
Raw Food Ingredients Storage and Processed Food Storage	0,533	Model entered denied
Food Serving	0,861	Model entered denied
Utensils	0,350	Model entered denied
Labor	0,001	Model entered

Table 12. Final Modeling of Multivariate

Variable	p value	PR (95%CI)
Location and Building	0,000	3,618 (1,925-6,799)
Food Processing	0,000	3,618 (1,925-6,799)
Labor	0,001	2,917 (1,550-5,489)

Based on the results of the multivariate analysis Table 12., it was found that the variables that had the most significant relationship with the restaurant assessment score were the location and building variables (0.000); food processing (0,000); and labor (0.001). The results of the analysis obtained the Prevalence Ratio (PR) of the location and building is 3.681, which means that a bad location and building can affect 0.3681 times higher than the location and good building. Likewise for the food processing variable which has PR = 3.681 and the labor variable which has PR = 2.917. From the results of the multivariate analysis, it can also be seen that the variables that have the greatest influence are the variables of location, building, and food processing.

5.3 Multivariate Analysis of Location and Building

In the restaurant sanitation hygiene assessment form, the location and building variables have assessment components consisting of location, building, division of space, floor, walls, ventilation, lighting, roof, ceiling, and doors. Bivariate analysis was carried out first in order to determine which components of the assessment most influenced the incidence of foodborne diseases. The results of the bivariate analysis can be seen in Table 13 below.

Table 13. Bivariate selection of location and building

Variable	p-value	State
Location	0,000	Model entered
Building	0,997	Model entered denied
Room Separating	0,997	Model entered denied
Floor	0,997	Model entered denied
Wall	0,997	Model entered denied
Ventilation	0,000	Model entered
Illumination	0,389	Model entered denied
Roof	0,380	Model entered denied
Ceiling	0,998	Model entered denied
Door	0,000	Model entered

Based on Table 13 above, it can be concluded that only the location, ventilation, and door variables were included in the multivariate modeling because they met the requirements for multivariate analysis with a p-value < 0.25. Then,

the final multivariate modeling was carried out on the location, ventilation, and doorways for the variables that had the greatest chance of causing foodborne illness. The modeling can be seen in Table 14 below

Table 14. Final multivariate modelling

Variable	*p-value*	PR (95%CI)
Location	0,000	3,409 (1,807-6,433)
Ventilation	0,000	0,293 (0,155-0,553)
Door	0,00	3,409 (1,807-6,433)

Based on the results of the multivariate analysis, it was found that the variable that had the most significant relationship with the restaurant assessment score was the location variable (0.000); ventilation (0,000); and doors (0,000). The analysis results showed that the Prevalence Ratio (PR) of the location variable was 3.409, meaning that a bad location had an effect of 3.409 times higher than a good location. Likewise for the ventilation variable which has PR = 0.293 and the door variable which has PR = 3.409. From the results of multivariate analysis, it can also be seen that the variables with the greatest influence are the location and door variables.

5.4 Proposed Improvements
In the restaurant industry, success and failure are largely determined by location factors. (Wang and Yan 2017). In this case, the factors of accessibility and appearance have an important role because they are related to the factor of comfort and strategic location (Hanaysha 2016). In addition, Liu et al. stated that in the restaurant industry, the intensity of consumers who come back is a good indicator and is evidence of the comfort and satisfaction offered (Wang and Yan 2017). Given this, the restaurant industry needs to pay attention to the population factor in an area so that it is easy to reach consumers (Wang and Yan 2017). This study shows that employees choose a restaurant not far from their place of work with their respective favorite menu choices. Another aspect that can attract consumers is the physical factor, both inside and outside the restaurant area. To protect the environment, the manager must be willing to provide a lot of funding for interior design, decoration, floor cleanliness, and other accessories. (Hanaysha 2016) In this study, restaurants that seem committed to maintaining their appearance are LG and RB restaurants in mall C The assessment score for RB is 842.5 or predicated Grade B and LG is 951.5 so it deserves to be predicated Grade A.

In British society, it is found that 85% of the population prepares and processes food at home at least once a day. (Redmond and Griffith 2003) Of these, 90-95% buy fresh meat, which has the potential to lead to contamination and the possibility of further infection. Therefore, hygiene sanitation practices must be carried out by consumers to reduce these risks. Responsibility regarding food safety refers more to consumers because consumers not only buy but also process and provide food for themselves and others (Redmond and Griffith 2003). Food processing includes activities that involve food handlers, places, tools, and processes to convert raw materials into products that are ready for consumption. An overview of the prevalence rate of food processing and foodborne diseases (gastroenteritis) can be seen in Table 8 above. From the table, it was found that good food processing caused 2 (1.6%) incidents of gastroenteritis in employees. Meanwhile, poor food processing caused 29 (33.7%) gastroenteritis in employees. The PR value = 1.251 (0.516-0.765), meaning that poor food processing increased 1.251 risks of gastroenteritis and was statistically significant (p = 0.000). This value is the highest PR value among all variables.

Commercial kitchens generally require a high ratio of floor area to air vents. (Li et al. 2007). Currently, most kitchens and dining rooms are equipped with an air circulation system, for example, Make-up Air Fans (MAF) or Make-up Air Units (MUA) to supply 50% -80% of the clean air that comes out of the exhaust system. The choice of location for placing the ventilation system equipment is very important, especially in a large area such as in the dining room (Kumari 2012). In this study, most of the restaurants are using a natural circulation system. The artificial circulation system is used in only a few restaurants, namely the PV, RB, S, and LG restaurants. In Table 4, it can be seen that the restaurant scored above 450. While other restaurants, namely SK and SM, implemented an open dining room system that could help the air circulation system but increase the incidence of gastroenteritis.

Food in restaurants and food stalls is served in semi-open or fully open areas, making it easier for contamination from outside and inside the restaurant. (Maryam et al. 2015) Although it is not considered a pollutant, airborne microorganisms (airborne microorganisms) or bioaerosol are important parameters in determining quality air

especially in restaurants (6). Bioaerosol can be sourced from workers, organic waste, and bacterial growth which can trigger food contamination. (Maryam et al. 2015) The spread of this bioaerosol is highly dependent on human activities in the restaurant (8). This human activity can also cause dust accumulation and will eventually grow airborne microbial particulates (Maryam et al. 2015). In several studies on indoor restaurant air quality by Maryam et al. (2015), it was found that there are a lot of Gram-positive bacteria when compared to Gram-negative. (Maryam et al. 2015) Gram-positive rod-shaped bacteria are often associated with sources of outside air such as emissions of fuel, water, dust, air, feces, plants, wounds on the skin surface, or swollen wounds. Although most of the species are harmless to humans, the infection process can still occur in certain species of susceptible individuals. (Maryam et al. 2015) In this study it was shown that restaurants that implement open food serving areas are found in shopping centers that have high IBS rates, namely SK in shopping center A and restaurant SM in shopping center E. The highest IBS figure occurs in shopping center A with the existence of SK restaurant, which is a restaurant with open serving space and is located on the side of the road or in a parking area that is crowded with vehicles.

6. Conclusion

With various considerations, shopping center employees buy lunch at the shop or restaurant closest to the workplace, most of which do not meet the hygiene sanitation requirements or non-grade. All assessment variables are on form RM.02 as stated in the Minister of Health Decree no. 1098 of 2003 concerning Hygiene Requirements for Restaurant/ Restaurant Sanitation, relating to the emergence of foodborne diseases or gastroenteritis. Based on the bivariate analysis, food ingredients and processed foods have a 10,662 times greater chance of developing foodborne illness (gastroenteritis) than good food and processed foods. Meanwhile, based on the multivariate analysis, the biggest variables that have the potential to cause foodborne disease incidence are food processing, the location of the facilities, and the main door of the restaurant which functions to protect the restaurant area from wind and dust. This is in accordance with the statement about the presence of bioaerosol in restaurants which is greatly influenced by human activities in or around the restaurant. (Maryam et al. 2015) Without mentioning the name of a food processing place, we should be aware of the emergence of gastroenteritis symptoms based on these factors.

In relation to the Covid-19 pandemic, this study shows that shopping centers, as one of the places where people gather to do activities together, need to be a concern, among others, through the personal hygiene of their employees, which can be started from restaurant choices and food menus so that they do not become a new cluster in the spread of Covid-19. It needs to be noted that people who suffer from gastroenteritis are not always has infected by the Covid-19 virus, but people who are infected by Covid-19 develop symptoms of diarrhea. It was stated in a study that as many as 17 patients or 23.3% showed a positive result of SARS-CoV-2 RNA in the stool test, even though the respiratory test was negative. (D'Amico et al. 2020) Complaints related to the intestines and other stomach disorders accompanied by respiratory problems are common symptoms of family infection with the coronavirus family. The first retrospective or cohort study evaluating the presence of symptoms of gastroenteritis with SARS was conducted in Hong Kong in 2003. (D'Amico et al. 2020)

References

Cai, et al., Indirect virus transmission in cluster of COVID-19 cases, Wenzhou, China, 2020, *Emerging Infectious Diseases*, vol. 26, no. 6, pp. 1343–1345, 2020.

Chen, et al., Continuous commissioning of commercial kitchen and dining facilities – case study, *ICEBO - International Conference for Enhanced Building Operation*s, pp. 1–7, 2007.

Children, et al., Diagnosis epidemic, vol. 38, no, 3, 2020.

D'Amico, et al., Diarrhea during COVID-19 infection: pathogenesis, epidemiology, prevention, and management, *Clinical Gastroenterology and Hepatology*, vol. 18, no. 8, pp. 1663–1672, 2020.

Erickson, et al., Bacteria facilitate enteric virus co-infection of mammalian cells and promote genetic recombination, *Cell Host and Microbe*, vol. 23, no. 1, pp. 77-88, 2018.

Getto, L., Zeserson, E., and Breyer, M., Vomiting, diarrhea, constipation, and gastroenteritis, *Emergency Medicine Clinics of North America*, vol. 29, no. 2, pp. 211–237, 2011.

Guest, et al., Foodborne Snow Mountain Agent Gastroenteritisin a Scholl Cafetaria, *Pediatric*, vol. 79, no. 9, pp. 559–563, 1987.

Hanaysha, J., Restaurant location and price fairness as key determinants of brand equity: a study on fast food restaurant

industry, *Business and Economic Research*, vol. 6, no. 1, pp. 310, 2016.

Hanaysha, J., Testing the effects of food quality, price fairness, and physical environment on customer satisfaction in fast food restaurant industry, *Journal of Asian Business Strategy*, vol. 6, no. 2, pp. 31–40, 2016.

Sugianto, H., Setyowati, E. G. H., Shopping mall di kota Pekalongan, *Maji*, vol. 1, no. 6, pp. 1109–1116, 2012.

Talley et al., Assessment of functional gastrointestinal disease: the bowel disease questionnaire, *Mayo Clinic Proceedings*, vol. 65, no. 11, pp. 1456–1479, 1990.

Kumari, P., Kitchen and dining space: as a way of eating manner in missing community, *IOSR Journal of Humanities and Social Science*, vol. 4, no. 5, pp. 23–28, 2012

Kurniadi, Y., Saam, Z. and Afandi, D., Faktor kontaminasi bakteri E. Coli pada makanan jajanan di lingkungan kantin sekolah dasar wilayah Kecamatan Bangkinang, *Program Studi Ilmu Lingkungan PPS Universitas Riau*, vol. 7, no. 1, pp. 29, 2013.

Majowicz et al., The global burden of nontyphoidal Salmonella Gastroenteritis, *Clinical Infectious Diseases*, vol. 50, no. 6, pp. 882–889, 2010.

Maryam, Z. et al., Indoor microbial contamination through water mist aerosol at public restaurants', *Jurnal Teknologi*, vol. 77, no. 24, pp. 45–50, 2015.

Mekonen, Y. M. and Keskes Melaku, S. Significance of HACCP and SSOP in Food Processing Establishments', *World Journal of Dairy & Food Sciences*, vol. 9, no. 2, pp. 121–126, 2014.

Nuryani, D., Adiputra, N. and Sudana, I. B. Kontaminasi Escherichia Coli Pada Makanan Jajanan Di Kantin Sekolah Dasar Negeri Wilayah Denpasar Selatan', *ECOTROPHIC: Jurnal Ilmu Lingkungan (Journal of Environmental Science)*, vol. 10, no. 1, pp. 28, 2016.

Pala, K. et al., Asymptomatic carriage of bacteria in food workers in Nilüfer district Bursa Turkey, *Turkish Journal of Medical Sciences*, vol. 40, no. 1, pp. 133–139, 2010.

Redmond, E. C., and Griffith, C. J., Consumer food handling in the home: A review of food safety studies, *Journal of Food Protection*, vol. 66, no. 1, pp. 130–161, 2003.

Rodríguez-Caturla, et al., Evaluation of hygiene practices and microbiological status of ready-to-eat vegetable salads in Spanish school canteens, *Journal of the Science of Food and Agriculture*, vol. 92, no. 11, pp. 2332–2340, 2012.

Shariatifar, N., The importance of food safety and its challenges in human health, vol. 3, no. 3, pp. 4–5, 2017.

Smith, J. L., and Bayles, D., Postinfectious irritable bowel syndrome: a long-term consequence of bacterial gastroenteritis, *Journal of Food Protection*, vol. 70, no. 7, pp. 1762–1769, 2017.

Wang, J., and Yan, X., How location matters in restaurant success?, *Proceedings of the 21st Pacific Asia Conference on Information Systems (PACIS)*, 2017.

Whitehead, W. E., Palsson, O. S., and Simrén, M., Irritable Bowel Syndrome: what do the new Rome IV diagnostic guidelines mean for patient management?, *Expert Review of Gastroenterology and Hepatology*, vol. 11, no. 4, pp. 281–283, 2017.

Wilhelmi, I., Roman, E., and Sánchez-Fauquier, A., Viruses causing gastroenteritis, *Clinical Microbiology and Infection*, vol. 9, no. 4, pp. 247–262, 2003.

Biographies

Veniranda Neny Widyastuti, is a student of the public health faculty postgraduate program at Sriwijaya University based on Palembang-Sumatera Selatan, an officer in the Health District of Palembang who focusing on food and beverage hygiene and sanitation for almost 20 years.

Hermansyah and Yuanita Windusari are Associate Professors, in Sriwijaya University Palembang-South Sumatera, with biology subject course.