

Association Between Food Handlers Hygiene and Food Sanitation to the Contamination of Salmonella Sp. on Sempol

Putri Mustika Nopriani
Department of Public Health
Universitas Negeri Malang
Malang, Indonesia
putrimn96@gmail.com

Supriyadi
Department of Public Health
Universitas Negeri Malang
Malang, Indonesia
Supriyadi.fik@um.ac.id

Agung Kurniawan
Department of Public Health
Universitas Negeri Malang
Malang, Indonesia
Agung.kurniawan.fik@um.ac.id

Hartati Eko Wardani*
Department of Public Health
Universitas Negeri Malang
Malang, Indonesia
hartati.eko.fik@um.ac.id

Abstract— Food contamination could become the cause of high incidence of typhoid fever in Malang. Sempol is a well known traditional food in Malang, Indonesia, made from chicken meat and egg. Bad hygiene and sanitation in processing and selling will impact to contamination of Salmonella sp on Sempol. The purpose of this study was to determine the association between food handlers' hygiene and food sanitation to the presence of Salmonella sp. on Sempol in the Lowokwaru District of Malang City. From data analysis by Chi Square there is association between personal hygiene (p-value = 0.011), equipment sanitation of food storage (p-value = 0.032), food processing (p-value = 0.032) and transport of cooked food (p-value = 0.032) to contamination of Salmonella sp. on Sempol.

Keywords— food handlers, hygiene and sanitation, food processing, salmonella sp, Sempol

I. INTRODUCTION

Salmonella sp is one pathogen causing food contamination beside Eschericia coli and Staphylococcus aureus [1]. According to data from the Malang City Health Service in 2018, it was stated that the recapitulation of typhoid fever from Public Health in Malang reported that the number of typhoid clinical cases was 659 and positive WIDAL test cases were 1,175 [2]. According to WHO (2018) about 11 and 21 million cases and 128,000 to 161,000 deaths related to typhus occur annually throughout the world. In Indonesia, a common disease suffered by people due to Salmonella sp. namely gastroenteritis and typhoid fever (typhoid disease). There was a significant relationship between factors that cause a history of consuming salmonella-contaminated snacks with the incidence of gastroenteritis p-value of $0.005 < 0.05$ [3]. Hawaiian food is a typical food from Malang that is produced by street vendors who sell their food on the side of the road or in the center of the crowd. Food can play a role as one of the factors causing the spread of disease, namely as an intermediary for bacteria or known as Food Borne Disease on the identification of the number of bacterial colonies and types of bacteria on the snacks sold by merchants located around 3 campuses such as

UM, UNISMA and UB in Malang is known that from the 6 samples tested using the method All TPC (Total Plate Count) do not meet the requirements for safe consumption because they exceed the maximum limit of microbial contamination for meats such as processed meats of 1×10^5 colonies / g based on the BPOM in 2009. Sources of contamination of animal food microorganisms are various types of bacteria pathogens but which are usually found and cause food poisoning are Eschericia coli, Staphylococcus aureus and Salmonella sp.

II. METHOD

The design in this study uses analytic survey observational research methods with cross sectional. Test the content of salmonella sp. conducted at the Laboratory of Plant Improvement University of Muhammadiyah Malang. The subject of this research is Sempol Traders. The sampling technique in this study used a total sampling technique or a total population sample of 24 people. Data collection techniques or instruments using questionnaires and laboratory tests. Data analysis included univariate and bivariate analyzes using the Fisher's Exact test. The design in this study uses analytic survey observational research methods with cross sectional. Test the content of salmonella sp. conducted at the Laboratory of Plant Improvement University of Muhammadiyah Malang. The subject of this research is Sempol Traders. The sampling technique in this study used a total sampling technique or a total opulation sample of 24 people. Data collection techniques or instruments using questionnaires and laboratory tests. Data analysis included univariate and bivariate analyzes using the Fisher's Exact test.

III. RESULT AND DISCUSSION

The following is an overview of the characteristics of food handlers who are the subject of research and the results of the analysis between Food Handlers Hygiene and Food Sanitation Against Salmonella Sp. In Sempol Snacks in Malang Lowokwaru District, which is the subject of research in Malang Lowokwaru District.

TABLE I. CHARACTERISTICS OF RESPONDENTS

Characteristics	Indicators	Total	Percentage (%)
Age	Late adolescence	7	29.2
	Early adulthood	9	37.4
	Late adulthood	6	25.2
	Early elderly	1	4.2
	Late elderly	1	4.2
Gender	Male	22	91.7
	Female	2	8.3
Period of working (years)	1	6	25
	2	2	8.4
	3	7	29.2
	4	8	33.3
	5	1	4.2
Education	Elementary	8	33.3
	Junior high school	6	25
	Senior high school	10	41.7
	Diploma	-	-
	Bachelor	-	-
Income	< 2,000,000	7	29.2
	≥ 2,000,000	17	70.8

Sanitizing Material Selection	10	47.7
Good	14	58.3
Bad		
Storage of Sanitary Materials	19	79.2
Good	5	20.8
Bad		
Food Processing Sanitation	2	8.3
Good	22	91.7
Bad		
Sanitation For Transportation Of Cooked Food	24	100
Good	0	0
Bad		
Sanitation of Storage Cooked Food	12	50
Good	12	50
Bad		
Sanitation of Serving Cooked Food	13	54.2
Good	11	45.8
Bad		
The Presence of bacteria <i>Salmonella sp.</i>	3	12.5
There is	21	87.5
There is no		

Based on table 1. it can be seen that the frequency distribution of food handlers age of 24 food handlers obtained frequency distribution based on the most age, namely in the age range of 26-35 years amounted to 9 respondents (37.4%) and food handlers who have the age range of the age range of the least age age 46-55 years amounted to 1 respondent (4.2%) and in the age range 56-65 amounted to 1 respondent (4.2%). Frequency distribution which has the most male gender is 22 respondents (91.7%) and food handlers who have female sex only amount to 2 respondents (8.3%). Distribution The highest frequency of food handlers who have worked for 4 years is 8 respondents (33.3%) and food handlers who have the least working period, namely for 5 years amounting to 1 person (4.2%). Frequency distribution of food handlers who have the most recent educational history, namely senior high school amount 10 respondents (41.7%) and those who have the least educational history, namely junior high school amount 6 food respondents (25%). Frequency distribution of food handlers who have income per month \geq 2,000,000.00 is 17 respondents (70.8%) more than food handlers who have income per month \leq 2,000,000.00 only amounts to 7 respondents (29.2%).

TABLE II. RESULTS OF UNIVARIATE ANALYSIS OF FOOD HANDLERS HYGIENE VARIABLES AND FOOD PROCESSING SANITATION VARIABLES AND THE EXISTENCE VARIABLES OF SALMONELLA BACTERIA SP.

Variables	Total	Percentage (%)
Hygiene Food Handlers		
Health Food Handlers	3	12.3
Healthy	21	87.5
Unwell		
Personal Hygiene	11	45.8
Good 11 45,8	13	54.2
Bad		
Food Processing Sanitation		
Sanitary Equipment	11	12.3
Qualify	13	87.5
Not Eligible		
Water Sanitation	15	65.2
Qualify	9	37.5078
Not Eligible		

Based on Table 2. it can be seen that the frequency distribution of food handlers belonging to the category of unhealthy behavior is 21 respondents (87.5%), while those belonging to the healthy behavior category only amount to 3 respondents (12.5%). Frequency distribution of food handlers, most of them had bad personal hygiene, amounting to 13 respondents (54.2%), while those classified as having good personal hygiene were 11 respondents (45.8%). Frequency distribution of food handlers mostly have equipment sanitation category that does not meet the requirements amounting to 13 respondents (54.2%), while those classified as having equipment sanitation category who meet the requirements amount to 11 respondents (45.8%). The frequency distribution of food handlers mostly has the category of water sanitation that meets the requirements of 15 respondents (65.2%), while those classified as having water sanitation that does not meet the requirements are 9 respondents (37.5%). Frequency distribution of food handlers, most of them have poor selection of food sanitation for 14 respondents (58.3%), while those classified as having good sanitation for raw material selection are 10 respondents (41.8%).

The distribution of frequency of food handlers mostly has good sanitation for food storage, 19 respondents (79.2%), while those classified as having bad food storage sanitation are 5 respondents (20.8%). Frequency distribution of food handlers mostly have poor food processing sanitation, amounting to 22 respondents (91.7%), while those classified as having good food selection sanitation amounted to 2 respondents (8.3%). The frequency distribution of food handlers all has good Sanitation of Food Transport Transportation with 24 respondents (100%). The frequency distribution of food handlers all has good cooking food sanitation with 12 respondents (50%) and poor cooking food sanitation with 12 respondents (50%) Frequency distribution of food handlers who have sanitation Good serving food cooks with 13 respondents (54.2%), while food handlers who had poor sanitation in serving food served were 11 respondents (45.8%). The frequency distribution of the 24 samples tested contained 3 samples of bacterial snacks that were positive for bacteria

containing *Salmonella* sp. and 21 negative samples containing *Salmonella* sp.

TABLE III. BIVARIATE ANALYSIS RESULTS BETWEEN FOOD HANDLERS HYGIENE AND SANITATION FOOD PROCESSING OF *SALMONELLA* SP. ONSNACK SEMPOL IN LOWOKWARU DISTRICT, MALANG CITY

Variable	PR	p-value
V ₁ Food Handlers Health	5,5	0,239
V ₂ Personal Hygiene Food Handlers	0,45	0,011*
V ₃ Sanitary Equipment	0,09	0,011*
V ₄ Water Sanitation	0	1,000
V ₅ Sanitizing Material Selection	0	1,000
V ₆ Storage of Sanitary Materials	0,714	0,032*
V ₇ Food Processing Sanitation	0,714	0,032*
V ₈ Sanitation For Transportation Of Cooked Food		
V ₉ Sanitation of Storage Cooked Food	0	0,032*
V ₁₀ Sanitation of Serving Cooked Food	0	1,000
	0	1,000

Based on Table 3. it was found that the Food handler's Health variable has a p value of 0.239 ($p > 0.05$), which means there is no significant relationship between the Food Handler's Health to the contamination of salmonella sp. on the sempo. The Food Handlers Personal Hygiene variable has a p value of 0.011 ($p < 0.05$), which means there is a significant relationship between the Food Handlers Personal Hygiene to the contamination of salmonella sp. on sempo. Variable Sanitation Equipment has a p value of 0.011 ($p < 0.05$), which means that there is a significant relationship between Sanitation Food Handling Equipment to the contamination of salmonella sp. on the sempo. Water sanitation variable p-value of 1,000 > 0.05 which means there is no significant relationship between water sanitation to the contamination of salmonella sp. on the sempo. Material Selection Sanitation Variable obtained p-value of 1,000 > 0.05 which means there is no significant relationship between Material Selection Sanitation to the contamination of salmonella sp. on the sempo.

Food Storage Sanitation Variable obtained p-value of 0.032 < 0.05 , which means there is a significant relationship between the Food Storage Sanitation variable to the contaminaton of salmonella sp. on the sempo. Food Processing Sanitation Variable obtained p-value of 0.032 < 0.05 which means there is a significant relationship between Processing Sanitation with the presence of salmonella sp. on the sempo. Cook Food Sanitation Variable obtained p-value of 0.032 < 0.05 which means there is a significant relationship between Sanitation of Cook Food Transport to the contamination of salmonella sp. on the sempo. Cooking Food Sanitation obtained p-value of 1,000 > 0.05 which means there is no significant relationship between Cooking Food Storage Sanitation to the contamination of salmonella sp. on the sempo. Variable Sanitation of Cooking Food to the contamination p-value of 1,000 > 0.05 which means that there is no significant relationship between Sanitation of Cooking Food Presentation to the contamination of salmonella sp. on the sempo.

IV. DISSCUSSION

A. *The Relationship Between Personal Hygiene and the Contamination of Salmonella Bacteria Sp. At Sempo*

Statistical test results using the Fisher's Exact test with a significance value $\alpha = 0.05$ and 95% confident interval obtained p-value of $0.011 < 0.05$ which means there is a significant relationship between personal hygiene and the of salmonella sp. on sempo. There is a significant relationship between traders' hygiene practices with batagor microbiological quality [4]. In line with Lamda test results obtained p value of $0.038 < 0.05$ which means that there is a relationship between hygiene of traders with salmonella sp contamination in cut chicken meat at Pekanbaru Traditional Market [5].

This can occur because in this study as many as 19 people with a percentage (79.2%) had implemented the behavior of washing hands with soap and running water while 4 people with a percentage (16.7%) of food handlers had not applied the behavior of washing hands with soap and water flow. Not only that food handlers as many as 17 people with a percentage (70.8%) are also known to rarely wash their hands after BAB / BAK and as many as 16 food handlers never cut their nails when long. It is thought that some food handlers were contaminated with salmonella sp because the bacteria hit the nails on the hands that were exposed to feces that were not washed with soap before. But this is not in line with research found that the results showed no significant relationship between the hygiene practices of street vendors with the presence of *Escherichia coli* contamination in elementary school snacks due to all bad hygiene practices [6].

B. *Relationship Between Equipment Sanitation and the Contamination of Salmonella Sp. At Sempo*

Statistical test results using the Fisher's Exact test with a significance value $\alpha = 0.05$ and a 95% confident interval obtained a p-value of $0.011 < 0.05$ which means there is a significant relationship between equipment sanitation and the salmonella sp. on the sempo. This is in line with research from the fisher test results it is known that there is a significant relationship between sanitation and the occurrence of salmonella contamination in chicken meat with a p value of 0.022 ($p < 0.05$) in terms of sanitation associated with the cleanliness of the equipment [7]. Tableware hygiene based on the presence of *Salmonella* sp. in Banda Aceh City food stalls, it was found that from 95 samples of food stalls examined through the smears of 24 food stalls, they were detected to contain *Salmonella* sp. on food utensils that are washed with water that does not flow and food storage equipment in the open. In this study *Salmonella* sp. it can also contaminate snacks by passing equipment such as a dirty knife [8].

This can happen because it is known as many as 22 food handlers the majority never routinely replace the dish washing sponge once a week with a percentage (91.7%). In line with this research about the bacterial population in the dishwashing sponge obtained by identification results through DNA-based molecular methods namely PCR-RFLP technique with cutting by restriction enzymes found four different patterns, different patterns indicate that there are 4 different populations living on sponges wet one of the microbes that is indicated to grow on

the sponge is *E. coli* which is a pathogenic bacterium [9]. From this it is not impossible to suspect that salmonella sp bacteria can also grow on sponges that are not routinely replaced at least once a week. In addition to almost all food handlers, 24 of them (100%) claimed that the majority of the chicken meat they bought had been cut by the chicken seller directly, as we know that chicken traders usually rarely washed knives every day so the knife was thought to have polluted by salmonella sp. This has been proven by research that results of the Chi Square test found that there was a significant relationship between equipment sanitation and the number of germs on chicken noodles with a p value of 0.018 so that ($p < 0.05$) with the swab inspection method on equipment used by noodle traders found more germ numbers high occurs in poor sanitation practices [10].

C. Relationship Between Sanitation of Food Storage and Contamination of Salmonella Sp. At Sempol

Statistical test results using the Fisher's Exact test with a significance value $\alpha = 0.05$ and a confident interval of 95% obtained a p-value of $0.032 < 0.05$ which means there is a significant relationship between sanitation of food storage and the contamination of salmonella sp. on the sempol. Pollution of Salmonella sp. respondents who have good storage sanitation practices are thought to be caused by the storage of the residual syrup that does not sell continuously for several days. In accordance with research that there is an influence of storage temperature and storage time with the growth of *Staphylococcus aureus* bacteria in ready-to-eat sausages with a p-value of $0.007 < 0.05$. This also allows growth can occur by the salmonella sp. in snacks snacks because the bacteria *Staphylococcus aureus* is also a mesophilic bacterium [11].

D. Relationship Between Sanitation of Food Processing and the Contamination of Salmonella Sp. At Sempol

Statistical test results using the Fisher's Exact test with a significance value $\alpha = 0.05$ and a 95% confident interval obtained a p-value of $0.032 < 0.05$ which means there is a significant relationship between sanitation processing and the salmonella sp. on the sempol. This can happen because in this study it is known that all food handlers are 24 people with a percentage (100%) grinding chicken meat for a doughol syrup in a general mill on the market. This is in line with research conducted by Tristia (2017). It is known that there is a significant relationship between hygiene behavior and sanitation of meat milling managers in Sleman Regency on the level of microbial contamination that exceeds the threshold in the meatball dough sample with a correlation coefficient value of -0.842 with an influence of (82.6%) and -0.815 with an influence of (71%).

Also in this study also found that most food handlers are rarely as many as 10 people and who have never washed or cleaned eggs from the rest of the dirt before processing it as many as 10 people. In line with study that by using a different housing system between conventional microbiologists and polymer chain reactions (PCR) which have been developed to detect the presence of salmonella sp. it is known that the PCR method successfully detected salmonella sp. on 2 egg sample shells. In this case the contamination of salmonella sp. during

processing it is possible because the rest of the manure (faeces) of chicken attached to the shell is then cooked incompletely [12].

E. Relationship Between Sanitation of Cooking Food Transportation and the Contamination of Salmonella Sp. At Sempol

The results of statistical tests using the Fisher's Exact test with a significance value $\alpha = 0.05$ and a 95% confident interval obtained a p-value of $0.032 < 0.05$ which means that there is a significant relationship between the sanitation of transporting cooked food and the salmonella sp. on the sempol. Salmonella sp. Bacterial contamination. This can be made possible because all food handlers are 24 people with a percentage (100%) on average all carrying cooked food in cold conditions for too long. According to interviews during the data collection process, it is known that the average food handler usually trades starting in the morning at 09.00 am to evening until 22.00, not only that food handlers also usually resell yesterday's leftover snacks that have not been sold in a refrigerator. first in the evening even though the transport temperature must be regulated ie in a hot state in $60\text{ }^{\circ}\text{C}$ or kept cold $60\text{ }^{\circ}\text{C}$.

Concerning the detection of food safety indicators on chicken meat sausages at Flamboyan Market in Pontianak stated that chicken meat sausages stored at room temperature (28°C - 30°C) for too long contain contamination of aerobic bacteria, *S. aureus* and *Salmonella* sp. With an average of average total bacterial growth on days 1,3 and 5 has exceeded the standards set by SNI (7388: 2009). It also does not rule out the possibility that the salmonella sp bacteria are thought to be able to grow during the process of transporting food snacks because the syrup is a processed material from chicken meat that is very prone to stale by room temperature if left too long similar to the nature of sausages [13].

F. Relationship Between Sanitation of Cooking Food Storage and the Contamination of Salmonella Sp. At Sempol

Statistical test results using the Fisher's Exact test with a significance value $\alpha = 0.05$ and a 95% confident interval obtained p-value of $1,000 > 0.05$ which means there is no significant relationship between sanitation of cooking food storage and the salmonella sp. on the sempol. The results are not significant in this study because it is known that as many as 18 food handlers with a percentage (75%) always keep ready meals in clean and separate containers. In this case, most food handlers use glass carts. It is also in accordance with the Republic of Indonesia Minister of Health Regulation No. 1096 / MENKES / PER / VI / 2011 which regulates the place or storage container must be separated for each type of food, the cover must be closed completely but still ventilated which can release water. Analysis of the presence of *Escherichia coli* factors in food has a different result that there is a significant relationship between processed food storage conditions with the presence of *E.coli* with p-value $0,000 < 0.05$ [14].

V. CONCLUSION

Based on the analysis using the Fisher's Exact test, it was obtained that as many as 5 variables such as personal hygiene, equipment sanitation, processing sanitation, sanitation of cooking food storage and food transportation sanitation which had a significant relationship to the *Salmonella* sp. on sempol in the Lowokwaru District of Malang City.

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