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The Relationship between Sanitary Hygiene and Coliform Bacteria Contamination at Refill Drinking Water Depots

Hubungan Hygiene Sanitasi Dengan Kontaminasi Bakteri Coliform Pada Depot Air Minum Isi Ulang

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Abstract

Objective: This study aims to determine the relationship between sanitation hygiene and Coliform bacteria contamination in refilled drinking water in Waled District in 2023.

Methods: This study uses an analytic observational design with a cross-sectional approach where the researcher will simultaneously observe or measure the independent and dependent variables (period). The sampling technique is total sampling with a sample of 30 refilled drinking water depots with 30 workers—data collection through observation and interviews. Data analysis was used, namely data analysis using Fisher's exact test.

Results: Based on laboratory tests, it was found that more than half of the refilled drinking water depots were contaminated with coliform bacteria as much as 60%. After analysis, it was found that factors related to Coliform bacteria contamination in filled drinking water were access to sanitation facilities (p = 0.001), and worker behavior (p = 0.001), while factors that were not related were drinking water treatment facilities (p = 0.063), raw water (p = 1.000) and consumer service hygiene (p = 0.418).

Conclusion: Of the five sanitation hygiene factors, those that have a significant relationship with coliform bacteria contaminants are sanitation facilities and behavior, while drinking water treatment facilities, raw water, and consumer service hygiene are factors that are not significant in determining bacterial contamination.

Keywords: sanitation hygiene, bacteria contamination, refill drinking water depot.

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Introduction

Drinking water is water that goes through a processing process or without a processing process that meets health requirements and can be drunk immediately.[1] Based on 2019 BPOM data, the high number of cases of poisoning in the West Java area is caused by drinking, namely as many as 405 cases, it is possible that this could be caused by bacteria coliform, but not much has been revealed in research and the data found. Drinking water is the primary source of consumption in the family, one of which is refilled drinking water because it is economical, especially for middle to lower-economic families. And not all drinking water depots provide good quality guarantees for the products they produce.[2]

According to YLKI 2012 (Indonesian Consumers Foundation), some refill depots in the Jakarta area do not meet refill standards, which affects the quality of the water sold. This statement is based on YLKI study results in various regions of Jakarta; the results found out of 20 samples, 6 contained Coliform bacteria, and 1 sample contained E.Coli bacteria.[3]

Data from BPS (Central Statistics Agency) 2018 then shows that water sources contaminated with bacteria in 10 of 24 provinces in Indonesia relatively high; one study from Padjadjaran University found that 50 percent of refilled gallon water in Bandung Regency was contaminated with E.Coli bacteria.[4]

The results of research by Makmur Selomo et al. in 2018, stated that essential aspects that need attention are aspects of cleanliness and behavior of handlers and the availability of basic sanitation facilities, including wastewater disposal facilities (SPAL), garbage disposal sites, and hand washing facilities.[5]

Research by Nurhanifah Siregar et al. in 2022 regarding depot sanitation, cleanliness, and analysis of total microbes controlling refill drinking water in the Barus sub-district. The results showed that most people use refilled drinking water for consumption. Because you don't need to cook it, it's cheap; you get coupons and delivery service, so you don't have to bother. Some drinking water depots are located close to main roads so that the surrounding environment is filled with dust, which means that the water is at risk of bacterial contamination because of the location, presentation and open packaging. This may endanger consumer health, and the origin of the water source is unknown.[6]

Research by Riska Epina Hayu, Fitri Mairizki, and Ermayulis 2018 shows that DAMIU continues to increase in line with the dynamics of people's needs for drinking water. However, not all DAMIU products are guaranteed safety. Kelurahan Pesisir, Kecamatan Lima Puluh, Pekanbaru City has twenty-one DAMIUs where periodic inspections of DAMIUs are rarely carried out. Kelurahan Pesisir was also included in the top ten cases of diarrhoea in 2014. The choice of DAMIU to meet the need for drinking water poses a risk to health if consumers ignore DAMIU sanitation hygiene.[7]

Research by Fina Arumsari et al. in 2021 regarding the relationship between hygiene and sanitation in drinking water depots and the presence of Escherichia coli in refilled drinking water in the Modokan sub-district, Sragen district shows that 22.2% of the existence of Escherichia coli bacteria in refill drinking water does not meet the requirements. As much as 40.7% of place sanitation, 22.2% of equipment sanitation, and 62.2% of hygiene of drinking water depot handlers are in the poor category. The results of the bivariate analysis showed that there was no relationship between place sanitation, equipment sanitation and the presence of Escherichia coli bacteria, while between handler hygiene and the presence of Escherichia coli bacteria, there was a significant relationship (p-value = 0.016).[8] Research in Tembalang District in 2017 showed that 85.1% of the samples did not meet the requirements for microbial contamination containing Coliform and Escherichia coli bacteria.[9]

DAMIU data from the Cirebon District Health Office in 2022 recorded 1,195 DAMIUs, of which 945 DAMIUs had permits, and the remaining 250 DAMIUs did not yet have permits.[10] The Cirebon District Health Office experienced difficulties in supervising refilled drinking water depots because this agency was not the provider of permits. The one-roof licensing service issues permits, while the Health service is only a provider of recommendations for the production, distribution and control of bottled drinking water (AMDK). This is why many drinking water depots do not meet health requirements.

Based on the results of a preliminary study conducted in November 2022, in the Waled Health Center UPTD area, out of 10 drinking water depot samples examined, there were 8 samples that did not meet the requirements and 2 samples that met the requirements, which means that 8 of the drinking water depot samples were contaminated with Coliform and E. coli bacteria.

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From the results of an interview with the Waled and Cibogo Health Center Environmental Health Program Manager on November 10, 2022, out of a total of 30 DAMIUs in the Waled District area, there has never been a DAMIU owner who has inspected his drinking water depot, whether it is raw water, processed water or the DAMIU workers/touchers themselves. The reasons for the owner of the DAMIU not having raw water, processed water and workers/handlers checked every three months are due to various reasons such as the high cost of inspection, the inspection site being far away, laziness, no time and lack of concern for hygiene and sanitation around the DAMIU itself.

Based on the background description, sanitary hygiene is a factor causing bacterial contamination, so researchers are interested in knowing "The Relationship between Sanitation Hygiene and Coliform Bacteria Contamination at Refill Drinking Water Depots in Waled District, Cirebon Regency in 2023."

Methods

The research design used is analytic observational, with a cross-sectional approach (cross-sectional) where researchers will simultaneously make observations or measurements of independent and dependent variables (period).[11]

The independent variables in this study are the completeness of sanitation facilities, drinking water treatment facilities, raw water, the hygiene of consumer service processes and the behavior of handlers/workers. In contrast, the dependent variable is Coliform bacteria.

The population in this study were all drinking water depot workers in Waled District, Cirebon Regency, totalling 30, using a total sampling technique. The instrument used was a questionnaire/checklist for drinking water depots. The checklist used in this study was taken from the Checklist for Sanitation Hygiene Supervision of Drinking Water Depots issued by the Environmental Health Section of the West Java Province Health Office in 2004. The laboratory examination instrument used the Total Plate test to determine Coliform bacteria contaminants contained in refilled drinking water. Count (TPC)/Total Plate Number (ALT) by isolating or planting bacteria in agar media.

Bivariate analysis was performed using the chi-square statistical test. This research was located in Waled District, Cirebon Regency, and was carried out from

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January to February 2023. In this study, attention was also paid to research ethics, including; the availability of filling in the informed consent/agreement sheet, anonymity/anonymity, confidentiality/confidentiality, and voluntary.

Results

Description of Coliform Bacteria Contamination in Refill Drinking Water Depots

Coliform bacteria contamination in refill drinking water depots was obtained from the results of laboratory tests, namely the Total Plate Count (TPC)/Total Plate Count (ALT) test, namely by isolating or planting bacteria in agar media, which was carried out in the Waled Health Center UPTD laboratory. The maximum level of microbiological parameters allowed in drinking water is 0 per 100 ml. An overview of Coliform Bacteria Contamination at Refill Drinking Water Depots in Waled District in 2023 can be seen in the following Table:

Table 1. Coliform Bacteria Contamination in Refill Drinking Water Depots

Coliform Bacteria Contamination	Amount	%
Uncontaminated	12	40
Contaminated	18	60
Total	30	100

Based on Table 1, the results obtained from 30 drinking water depot samples examined, more than half were contaminated with Coliform 18 bacteria (60%).

Complete sanitation facilities at refill drinking water depots

Table 2. Completeness of Sanitation Facilities at Refill Drinking Water Depots

Completeness of Sanitation Facilities	Amount	%
Ineligible	21	70
Eligible	9	30
Total	**30**	**100**

Table 2 shows that from 30 drinking water depot samples examined, more than half of the complete sanitation facilities did not meet the requirements of 21 (70%).

Drinking Water Treatment Facilities at Refill Drinking Water Depots

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Table 3. Drinking Water Treatment Facilities at Refill Drinking Water Depots

Drinking Water Treatment Facilities	Amount	%
Ineligible	19	63,3
Eligible	11	36,7
Total	**30**	**100**

Based on the results in Table 3, more than half of the drinking water treatment facilities did not meet the requirements, 19 (63.3%).

Description of Raw Water at Refill Drinking Water Depots

Table 4. Raw Water at Refill Drinking Water Depots s

Raw Water Quality	Amount	%
Ineligible	19	63,3
Eligible	11	36,7
Total	**30**	**100**

Based on the results of Table 4, more than half of the raw water does not meet the requirements as much as 19 (63.3%).

Description of Consumer Service Hygiene at Refill Drinking Water Depots

Table 5. Hygiene Consumer Service at Refill Drinking Water Depots

Hygiene Consumer Service	Amount	%
Ineligible	21	70
Eligible	9	30
Total	**30**	**100**

Based on the results of Table 5, more than half of the consumer services do not meet the requirements of 21 (70%).

Description of Worker Behavior at a Refill Drinking Water Depot

Table 6. Worker Behavior at Refill Drinking Water Depots

Worker Behavior	Amount	%
Ineligible	19	63,3
Eligible	11	36,7

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Total	**30**	**100**

Based on the results of Table 6. more than half of the worker's behavior does not meet the requirements as much as 19 (63.3%).

The Relationship Between the Completeness Of Sanitation Facilities And The Contamination Of Coliform Bacteria

Table 7. The relationship between the completeness of sanitation facilities and the contamination of Coliform bacteria

No	**Complete sanitary facilities**	**Coliform Bacterial Contamination**				**Total**		**P-Value**
		Unconta minated		**Contamin ated**				
		n	%	n	%	N	%	
1	Ineligible	4	19,0	17	80,9	21	100	0,001
2	Eligible	8	88,8	1	11,2	9	100	
Total		12	40,0	18	60,0	30	100	

Table 7 shows that the completeness of the sanitation facilities that did not meet the requirements was more than partially (80.9%) contaminated with coliform bacteria. In comparison, those that met the requirements most of the completeness of the sanitation facilities were not contaminated with coliform bacteria (88.8%).

The chi-square test results obtained a P-value = 0.001 <0.05, which means there is a significant relationship between coliform bacteria contamination and the completeness of sanitation facilities.

The Relationship between Drinking Water Treatment Facilities and Coliform Bacteria Contamination

Table 8. The relationship between drinking water treatment facilities and Coliform bacteria contamination

No	**Drinking water treatment facilities**	**Coliform Bacterial Contamination**		**Total**	**P-Value**
		Unconta minated	**Contamin ated**		

		n	%	n	%	N	%	
1	Ineligible	5	26,3	14	73,6	19	100	0,063
2	Eligible	7	63,6	4	36,6	11	100	
Total		12	40,0	18	60,0	30	100	

Based on Table 8 shows that drinking water treatment facilities that do not meet the requirements are more than partially (73.6%) contaminated with coliform bacteria. In comparison, most drinking water treatment facilities that meet the requirements are not contaminated with coliform bacteria (63.6%).

The chi-square test results obtained a P-value = 0.063 > 0.05, meaning there is no significant relationship between coliform bacteria contamination and drinking water treatment facilities.

The Relationship of Raw Water with Coliform Bacterial Contamination

Table 9. The relationship between raw water and Coliform bacteria contamination in refill drinking water depots

No	**Drinking water treatment facilities**	**Coliform Bacterial Contamination**				**Total**		**P-Value**
		Unconta minated		**Contamin ated**				
		n	%	n	%	N	%	
1	Ineligible	8	42,1	11	57,8	19	100	1,000
2	Eligible	4	36,3	7	63,6	11	100	
Total		12	40,0	18	60,0	30	100	

Table 9 shows that more than some raw water that does not meet the requirements (57.8%) is contaminated with coliform bacteria. In comparison, most raw water that meets the requirements (36.3%) is not contaminated with coliform bacteria.

The chi-square test results obtained a P-value = 1.000 > 0.05, meaning there is no significant relationship between coliform bacteria contamination and raw water quality.

The Relationship Between Consumer Service Hygiene and Coliform Bacteria Contamination

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Table 10. The relationship between raw water and Coliform bacteria contamination in refill drinking water depots

No	Hygiene customer service	Coliform Bacterial Contamination				Total		P-Value
		Unconta minated		Contamin ated				
		n	%	n	%	N	%	
1	Ineligible	7	33,3	14	66,6	21	100	0,418
2	Eligible	5	55,5	4	44,4	9	100	
Total		12	40,0	18	60,0	30	100	

Table 10 shows that the hygiene of consumer services that do not meet the requirements is more than half (66.6%) contaminated with bacteria.

While most consumer service hygiene met the requirements (55.5%), Coliform was not contaminated with coliform bacteria.

The chi-square test results obtained a P value = 0.418 > 0.05, meaning there is no significant relationship between coliform bacteria contamination and consumer service hygiene.

Relationship between Worker Behavior and Coliform Bacterial Contamination

Table 11. The relationship between Worker Behavior and Coliform bacteria contamination at refill drinking water depots

No	Worker behavior	Coliform Bacterial Contamination				Total		P-Value
		Unconta minated		Contamin ated				
		n	%	n	%	N	%	
1	Ineligible	3	15,7	16	84,2	19	100	0,001
2	Eligible	9	81,8	2	18,1	11	100	
Total		12	40,0	18	60,0	30	100	

Based on Table 11, it shows that the behavior of workers who do not meet the requirements is more than half (84.2%) contaminated with coliform bacteria, while most

of the behavior of workers who meet the requirements (81.8%) are not contaminated with coliform bacteria.

The results of the chi-square test obtained a P-value = 0.001 <0.05, which means that there is a significant relationship between coliform bacteria contamination and worker behavior.

Discussion

According to the study results, data on the distribution of respondents based on coliform bacteria contamination consisted of 18 contaminated drinking water depots (60%) and 12 refilled drinking water depots (40%) that were not contaminated. In line with the results of Fitri Mairizki's research in 2017 on 10 drinking water samples around the Riau Islamic University campus, it concluded that all drinking water samples studied did not meet the drinking water quality requirements based on Permenkes 492/Menkes/Per/IV/2010 in terms of biological parameters where in all samples found contamination of Coliform bacteria.[12] However, it is different from the results of Lidya Ayu Natalia's research in 2017, the test results of 25 samples of refilled drinking water in Blora Regency, 24 samples had good results or no evidence of Coliform bacteria contamination, while 1 sample of refill drinking water had very good results. bad, namely proven contamination of coliform bacteria.[13]

Differences in research locations can lead to different research results; besides that, many other factors make different research results; just a difference in place will make the source of raw water used different besides the completeness of facilities, processing facilities, hygiene and sanitation services and worker behavior.

Coliform bacteria contamination cannot be detected by sight, smell, or taste. The only way to know if a water supply contains bacteria is for it to be tested by a laboratory. All water has coliform bacteria. Coliform bacteria do not mean the water is unsafe to drink. Bacteria that can cause known diseases are pathogenic bacteri.[14]

The Description of the Completeness of Sanitation Facilities

According to the research results, the data distribution of respondents based on the completeness of sanitation facilities that did not meet the requirements was 21 (70%) refilled drinking water depots. This differs from the results of Epri Malisa Putri's research

in 2016, which found that 23 depots (76.7%) did not meet the requirements for complete sanitation facilities at refill drinking water depots in Seberang Ulu 1 District.[15]

In the results of this study, the sanitation equipment that did not meet the requirements included the unavailability of trash cans and places to wash hands (such as; no soap, running water and sinks available), while the reason they did not provide sanitation facilities was due to economic factors which were considered expensive and unnecessary. And this is the same problem found at every refilled drinking water depot.

The Description of Drinking Water Treatment Facilities

According to the study results, the data distribution of respondents based on drinking water treatment facilities that did not meet the requirements was more than half as many as 19 (63.3%) refilled drinking water depots. This is not in line with Epri Malisa Putri's 2016 study, which found that 12 depots (40%) did not meet the requirements for drinking water treatment facilities at refill drinking water depots in Seberang Ulu 1 District and 18 depots (60%) completed the requirements.[15]

Based on the research results, drinking water treatment facilities do not meet the requirements because the equipment used is not in its useful life (filter), grounds the price is relatively high. According to the Decree of the Minister of Industry and Trade of the Republic of Indonesia No. 651/MPP/Kep/10/2004 concerning Technical Requirements for Drinking Water Depots and Trading, Drinking water processing facilities are tools and equipment used for drinking water treatment must use equipment that complies with health requirements (food grade).[16]

The Description of Raw Water

According to the study results, 19 (63.3%) of the respondents' distribution data based on raw water did not meet the requirements for refilled drinking water depots. This does not follow research by Iis Rosyiah 2017 that 9 drinking water depots (15%) did not meet the criteria and 51 (85%) completed the requirements.[17]

The difference in the results of this study is due to the different research locations, so the raw water used is of varying quality. The Republic of Indonesia Government Regulation No. 16 of 2005 means raw water for drinking water can come from surface sources, groundwater basins and or rainwater that meets specific quality standards as drinking water.[18] Raw water is that which meets the requirements for clean

water, in accordance with the Minister of Health No. 416/Menkes/Per/IX/1990 regarding requirements and monitoring of drinking water quality.[19]

In the results of this study, the causes of raw water not fulfilling the requirements include not testing the quality of raw water, transportation of raw water that does not meet the requirements, storage of more than 3 days, storage with materials that contaminate water.

During the transportation of raw water to drinking water depots (DAMIU), attention must also be paid to raw water taken from open springs that the surrounding environment may contaminate; the process of taking raw water from springs to refill drinking water depots (DAMIU)), must be done using a tank car made from food grade, this is done so that the raw water is not polluted by microorganisms either from the environment or during the trip.[20]

The Description of Consumer Service Sanitation Hygiene

According to the study results, respondents' data distribution based on consumer service sanitation hygiene did not meet the requirements of 21 (70%) refill drinking water depots. This is similar to the results of Epri Malisa Putri's 2016 study that the process of customer service at refill drinking water depots in Seberang Ulu 1 Subdistrict 20 depots (66.7%) did not meet the requirements and 10 depots (33.3%) fulfilled the requirements.[21]

Research obtained regarding consumer service sanitation hygiene does not meet the requirements, including gallon containers to be filled not in a clean condition, container/gallon washing is not available by the manager, gallon washing being carried out in an open room, gallon containers are not given directly to customers.

The Description of Worker Behavior

According to the study results, the distribution of respondents based on the behavior of workers who did not meet the requirements was 19 (63.3%) refilled drinking water depots. This is in accordance with Epri Malisa Putri's 2016 study that the behavior of washing hands at refill drinking water depots in Seberang Ulu District 1 workers who do not wash their hands before and after serving consumers are 23 depots (73.3%) and those who wash their hands before and after serving consumers as many as 8 depots (26.7%)[21]. Widatul Mila et al.'s 2018 research, with the title Hygiene and Sanitation of Refill Drinking Water Depots in Banyuwangi District, Banyuwangi Regency, East Java, shows that 53.33% of DAMIU workers/handlers do not use clean and tidy work clothes

while working. Based on observations made by DAMIU, employees/workers only wear everyday clothes.[22] Meanwhile, according to the Indonesian Ministry of Health, operators must wear clean clothes, and uniforms, wear hair caps and wear them specifically when on duty, and wear official identification.[23]

Based on the results of research on the behavior of workers who did not meet the requirements, namely not washing their hands, it was also found that they were in an unhealthy condition and did not carry out periodic health checks once a year; this was also possibly due to limited funds.

The Relationship Between the Completeness of Sanitary Facilities and the Contamination of Coliform Bacteria

The results of this study indicate that the percentage of complete sanitation facilities for refill drinking water depots does not meet the requirements (TMS) compared to those that meet the requirements (MS). Coliform bacteria contamination. This is in accordance with Komang Tri AR et al.'s research in 2018 in the working area of the Denpasar Bali Health Center II that the completeness of sanitation facilities has a significant relationship with the bacteriological quality of refilled drinking water depots.[21]

According to the Regulation of the Minister of Health of the Republic of Indonesia Number 492/MENKES/PER/IX/2014 concerning requirements for drinking water, article 3 paragraph 1 says that drinking water must meet physical, microbiological, kiwiawi and radioactive requirements. The bacteriological requirements for drinking water are stated to meet the requirements of the drinking water used for household purposes containing coliform bacteria in 0/100 ml of the water sample.[22]

Based on research, most refill drinking water depots do not have complete sanitation facilities such as hand washing facilities, clean running water facilities, availability of soap for washing hands, availability of trash cans and availability of toilets/restrooms, which can affect coliform bacteria contamination. Because of this, the researchers assume that the completeness of sanitation facilities can affect coliform bacteria contamination in refilled drinking water depots.

The Relationship between Drinking Water Treatment Facilities and Coliform Bacteria Contamination

The results of this study indicate that the percentage of drinking water treatment facilities for refilled drinking water depots does not meet the requirements (TMS)

compared to those that meet the requirements (MS), Between drinking water treatment facilities with coliform bacteria contamination.

According to the Regulation of the Minister of Health of the Republic of Indonesia No. 736/Menkes/Per/VI/2010 concerning Procedures for Supervision of Drinking Water Quality, factors related to coliform bacteria contamination are drinking water treatment facilities[23]

Based on research, most of the drinking water treatment facilities at refill drinking water depots are made of food-grade materials, rust resistant, do not react with chemicals, the tools used are still in use and are not made of heavy metals, which can react with water. Because of this, the researchers assume that drinking water treatment facilities cannot affect coliform bacteria contamination in refilled drinking water depots.

The Relationship of Raw Water with Coliform Bacteria Contamination

The results of this study indicate that the percentage of raw water at refilled drinking water depots does not meet the requirements (TMS) compared to those that meet the requirements (MS).

This is in accordance with the research of Rahmida Nadia et al. 2022, the results of an analysis of standard drinking water sanitation in 36 samples of refill drinking water depots in the working area of the Telaga Dewa Health Center found no DAMIU that met the requirements. The owner of the drinking water depot cannot show a raw water supply certificate which is checked regularly, raw materials do not have a certificate which is updated periodically, and the quality of drinking water is very poor.[24]

Based on research, most of the quality of raw water at refill drinking water depots comes from clean sources, quality tests have been carried out, transportation takes less than 12 hours, is stored for less than 3 days, the raw water reservoir is protected from sunlight, and is free from contaminants. Because of this, the researchers assume that raw water quality has no effect on coliform bacteria contamination in refilled drinking water depots.

The Relationship between Consumer Service Hygiene and Coliform Bacterial Contamination

The results of this study indicate that the percentage of consumer service hygiene at refill drinking water depots does not meet the requirements (TMS) compared to those that meet the requirements (MS). This is evidenced by Fisher's exact test, the value of P

= 0.418 (P > 0.05), which statistically shows no relationship between consumer service hygiene and coliform bacteria contamination.

This is different from Mazda et al.'s research in 2021, which found that bacteria in refilled drinking water are influenced by several factors such as Raw Water Sources, Materials and Equipment, Processing Processes and Sanitary Behavior.[25]

The researcher assumes that the hygiene of consumer service at the refill drinking water depot is good enough for the gallon container to be filled in a clean condition, the manager provides the washing process, the gallon container is washed, and the washing is carried out in a closed room. The gallon container is given directly to the customer. Because of this, researchers assume that consumer service hygiene does not affect coliform bacteria contamination at refilled drinking water depots.

The Relationship between Worker Behavior and Coliform Bacterial Contamination

The results of this study indicate the behavior of many refilled drinking water depot workers who do not meet the requirements (TMS) compared to those who meet the requirements (MS). This is evidenced by the test results of the value of P = 0.001 (P <0.05), which Statistics show a relationship between worker behavior and coliform bacteria contamination. This is in accordance with the research of Fina Arumsari et al. 2021; from the results of the Fisher's exact test, which was carried out on the sanitary conditions of the equipment in the presence of Escherichia coli bacteria, a p-value of 0.016 was obtained. This shows that there is a relationship between handler hygiene and the presence of Escherichia coli bacteria in refilled drinking water in Mondokan District, Sragen Regency.[8]

Hasil penelitian ini sebagian besar perilaku pekerja/karyawan depot air minum isi ulang tidak mencuci tangan dengan sabun sebelum dan sesudah melayani pelanggan, membawa kuman penyakit, tidak berperilaku hygiene sanitasi setiap melayani konsumen, tidak menggunakan pakaian kerja, serta tidak pernah melakukan pemeriksaan kesehatan, yang dapat mempengaruhi kontaminasi bakteri *coliform* oleh karena hal tersebut peneliti beranggapan bahwa perilaku pekerja/karyawan dapat berpengaruh terhadap kontaminasi bakteri *coliform* pada depot air minum isi ulang.

Kebiasaan mencuci tangan sebelum bekerja dapat membantu memperkecil risiko terjadi kontaminasi bakteri dari tangan ke makanan. Hasil penelitian Alfian dkk pada 2017, menyatakan bahwa higiene petugas DAMIU merupakan salah satu faktor

yang dapat menyebabkan kontaminasi bakteri pada produk air minum. Selain itu, karyawan yang bekerja tidak melakukan cuci tangan terlebih dahulu sebelum melakukan pengisian air minum sebesar 60%. Kuku tangan sering menjadi sumber kontaminan atau mengakibatkan kontaminasi silang.[26]

Conclusion

It is possible to draw the following conclusion based on the research findings and discussion presented above. Out of the five sanitation hygiene factors, only two that have a significant relationship with coliform bacteria contaminants are sanitation facilities and behaviour. On the other hand, drinking water treatment facilities, raw water, and consumer service hygiene are not significant in determining the level of bacterial contamination.

References

1. Sumantri A. *Kesehatan Lingkungan*. Kencana Prenada Media Group; 2010.
2. BPOM. *Laporan Tahunan Pusat Data Dan Informasi Obat&Makanan Tentang Kasus Keracunan Nasional Berdasarkan Kelompok Penyebab*.; 2019.
3. YLKI. YLKI: air minum isi ulang tidak higienis. Accessed July 25, 2023. https://www.bbc.com/indonesia/berita_indonesia/2013/02/130215_ylki_air_minum_ulang
4. Khalilullah MA. Banyak Air Galon Isi Ulang Mengandung Bakteri E Coli, Ini Ciri-cirinya » DIALEKSIS :: Dialetika dan Analisis. Published 2021. Accessed July 25, 2023. https://dialeksis.com/berita/banyak-air-galon-isi-ulang-mengandung-bakteri-e-coli-ini-ciri-cirinya/
5. Selomo M, Natsir MF, Birawida AB, Nurhaedah S. Hygiene Dan Sanitasi Depot Air Minum Isi Ulang Di Kecamatan Campalagian Kabupaten Polewali Mandar. *J Nas Ilmu Kesehat*. 2018;1(2):1-11.
6. Siregar N, Tanjung WW, Harahap LJ. Depot Sanitation, Hygiene, and Analysis of Total Microba Control in Refilled Drinking Water in The Barus District. *Int J Basic Appl Sci*. 2022;10(4):154-162. doi:10.35335/IJOBAS.V10I4.68
7. Hayu RE, Mairizki F. Higiene Sanitasi dan Uji Escherichia Coli Depot Air Minum Isi Ulang (DAMIU) di Kelurahan Pesisir, Kecamatan Lima Puluh, Kota Pekanbaru. *J Kesehat Vokasional*. 2018;3(2):74-80. doi:10.22146/JKESVO.38565
8. Arumsari F, Joko T, Darundiati YH. Hubungan Higiene Sanitasi Depot Air Minum dengan Keberadaan Bakteri Escherichia coli pada Air Minum Isi Ulang di Kecamatan Mondokan Kabupaten Sragen. *MEDIA Kesehat Masy Indones*. 2021;20(2):75-82. doi:10.14710/MKMI.20.2.75-82
9. Utami ES, Martini M, Lintang DS, Purwantisari S. Hubungan Kualitas Mikrobiologi Air Baku Dan Higiene Sanitasi Dengan Cemaran Mikroba Pada Air Minum Isi Ulang Di Kecamatan Tembalang. *J Kesehat Masy*. 2018;6(1):236-244. doi:10.14710/JKM.V6I1.19874

10. Cirebon DKK. *No Title*.; 2022.
11. Harlan J, Sudjiati R. *Metodologi Penelitian Kesehatan*. Gunadarma
12. Mairizki F. Analisa Kualitas Air Minum Isi Ulang Di Sekitar Kampus Universitas Islam Riau. *J Katalisator*. 2017;2(1):9-19. doi:10.22216/JK.V2I1.1585
13. Natalia LA. *Kajian Kulaitas Bakteriologis Air Minum Isi Ulang Di Kabupaten Blora Melalui MPN*. Universitas Negeri Semarang; 2017.
14. Puspawati C, Prabowo K, Pujiono. *Kesehatan Lingkungan Teori Dan Aplikasi*. Buku Kedokteran EGC; 2019.
15. Putri EM. *Hubungan Sanitasi Dengan Kontaminasi Coliform Pada DAMIU Kecamatan Seberang Ulu Palembang*. UIN; 2018.
16. *Keputusan Menteri Perindustrian Dan Perdagangan RI Tentang Usaha Depot Air Minum*.; 2004.
17. Rosyiah I. *Faktor-Faktor Yang Berhubungan Dengan Kualitas Air Minum Secara Bakteriologis Pada Depot Air Minum Di Kabupaten Majalengka Tahun 2017*. STIKes Cirebon; 2017.
18. *Peraturan Pemerintah RI No. 16 Tahun 2005 Tentang Pengembangan Sistem Penyedian Air Minum*.; 2005.
19. *Peraturan Menteri Kesehatan RI No. 416/Menkes/Per/IX/1990 Tentang Syarat-Syarat Pengawasan Kualitas Air Minum*.; 1990.
20. Mila W, Nabilah SL, Puspikawati SI. Higiene dan Sanitasi Depot Air Minum Isi Ulang di Kecamatan Banyuwangi Kabupaten Banyuwangi Jawa Timur : Kajian Deskriptif. *J Ilmu Kesehat Masy*. 2020;16(1):7-15. doi:10.19184/IKESMA.V16I1.14841
21. Rahayu KTA, Sumadewi NLU, Astuti NPW. Kualitas Bakteriologis dan Higiene Sanitasi Pada Depot Air Minum Isi Ulang di Wilayah Kerja Puskesmas II Denpasar Barat. *Hig J Kesehat Lingkung*. 2018;4(3):177-182.
22. *Peraturan Menteri Kesesehatan RI No. 492/MENKES/Per/IX/2014 Tentang Air Minum*.; 2014.
23. *Peraturan Menteri Kesehatan RI No. 736/Menkes/Per/VI/2010. Tentang Tata Laksana Pengawasan Kualitas Air Minum*.; 2010.
24. Nadia R, Wati N, Amin M, Angraini W. Analisis Penilaian Sanitasi Pada Depot Air Minum Isi Ulang Di Wilayah Kerja Puskesmas Telaga Dewa Kota Bengkulu. *Avicenna J Ilm*. 2022;17(02):109-124. doi:10.36085/AVICENNA.V17I02.3431
25. Mazda M. Analisis Kualitas Sumber Air Baku Pada Sumur Bor Di Depot Air Minum Isi Ulang (Studi Kasus Depot Air Minum Isi Ulang (Damiu) Di Kabupaten Seluma). *Nat J Penelit Pengelolaan Sumber Daya Alam dan Lingkung*. 2021;10(1):156-162. doi:10.31186/NATURALIS.10.1.18162
26. Alfian A, Surahma AM, Santri IN. Hubungan Higiene Petugas Depot Galon Dengan Jumlah Bakteri E. Coli Air Minum Pada Depot Air Minum Isi Ulang (Damiu) Di Kecamatan Umbulharjo Dan Kecamatan Kotagede Yogyakarta. *J Kesehat dan Pengelolaan Lingkung*. 2021;2(2):146-151. doi:10.12928/JKPL.V2I2.6349