THE RELATIONSHIP BETWEEN SANITARY HYGIENE AND THE PRESENCE OF *ESCHERICHIA COLI* IN ICED SUGARCANE JUICE SOLD IN TEBING TINGGI CITY

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ABSTRACT

Iced sugarcane juice that contains coliform bacteria indicates the presence of microbiological contamination. Contamination by pathogenic bacteria such as Escherichia coli can lead to various health problems, including gastrointestinal infections, diarrhea, and other diseases. This study aims to analyze the relationship between hygiene and sanitation practices and the presence of Escherichia coli in iced sugarcane juice sold in Tebing Tinggi City. This research is a quantitative study with an observational design using a cross-sectional approach. The population consisted of all iced sugarcane juice vendors in Tebing Tinggi City (57 vendors), with 31 selected as samples through simple random sampling. Laboratory testing was conducted at the Public Health Laboratory Center (BLKM) in Medan. Bivariate analysis showed a significant relationship between hygiene and sanitation variables (p = 0.043; PR = 3.259), food handler hygiene (p = 0.027; PR = 1.943), equipment sanitation (p = 0.032; PR = 1.789), and sanitation facilities (p = 0.045; PR = 1.579) with the presence of Escherichia coli in iced sugarcane juice sold in Tebing Tinggi City. It is expected that iced sugarcane juice vendors implement proper hygiene and sanitation practices to prevent microbiological contamination and protect consumer health.
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Keywords**: **Escherichia Coli, Hygiene and Sanitation, Iced Sugarcane Juice

Introduction

Snack drinks such as cane ice are one of people's favorite choices because of their sweet and fresh taste. Cane ice is easy to find in various places, including traditional markets, roadsides, and crowded areas. In addition to offering freshness, cane ice is also believed to have health benefits. However, behind its popularity, often the quality of cane ice sold is overlooked, especially when it comes to hygiene and sanitation. This condition can increase the risk of microbiological contamination, one of which is by bacteria *Escherichia coli*, which has the potential to cause health problems in consumers (Sandika et al., 2019).

Food sanitation is one of the prevention efforts that emphasizes all actions and activities necessary to keep food and beverages free from health threats starting from before the food is produced, the processing process, preparation, transportation, serving, to when the food and beverages are ready for consumption (Rahmah, 2022).

Food contamination often occurs due to unhygienic food handlers, one of which is caused by microbes *Escherichia coli*. These microbes can easily spread

through polluted water or unhygienic environments. Food contamination by *Escherichia coli* can occur when food or equipment that comes into direct contact with water or a polluted environment shows the results of laboratory tests containing these microbes. This indicates that the food is contaminated by human waste (Nasution, 2022).

According to a report by the World Health Organization (WHO), every year around 600 million people in the world experience food poisoning, with 125,000 of them dying.(Organization, 2020) In Indonesia, cases of poisoning due to food and beverages contaminated with pathogenic microorganisms, including *Escherichia coli*, is also often reported. Data from the Ministry of Health states that 20-30% of food poisoning cases in Indonesia are related to drinks and street food, which often do not meet hygiene and sanitation standards (Kementerian Kesehatan RI, n.d.).

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2023 concerning the Implementation Regulation of Government Regulation Number 66 concerning Environmental Health, the maximum level of *Escherichia coli* which is allowed in drinking water and water for hygiene and sanitation purposes, which is 0 CFU/100 ml. However, for the Environmental Health Quality Standard (SBMKL) of ready-to-eat processed food media, the maximum level *Escherichia coli* The maximum allowable is <3.6 MPN/gr or <1.1 CFU/gr (Kementerian Kesehatan, 2023).

Existence *Escherichia coli* In sugarcane ice drinks, not only does it have an impact on individual health such as diarrhea, vomiting, and gastrointestinal infections, but it can also trigger extraordinary events (KLB) of food poisoning in the community.(Aufani et al., 2023) In developing countries such as Indonesia, diarrhea is still a significant health problem. Diarrheal disease is an endemic disease that has the potential to cause Extraordinary Events (KLB) and is still a contributor to mortality rates in Indonesia, especially in toddlers (Kementerian Kesehatan RI, 2024).

Based on data from the 2023 Indonesian Health Survey (SKI), the prevalence of diarrhea at all ages at the national level was recorded at 2.0% (95% CI: 1.9 - 2.1), with the prevalence of diarrhea accompanied by symptoms reaching 4.3% (95% CI: 4.2 - 4.4). Meanwhile, in North Sumatra Province, the prevalence of diarrhea in all ages was slightly higher, at 2.3% (95% CI: 2.1 - 2.6), and the prevalence of diarrhea with symptoms reached 4.7% (95% CI: 4.1 - 5.4). The prevalence rate of diarrhea in North Sumatra shows that it is higher than

the national rate.(SKI, 2023) Based on data from the Central Statistics Agency of North Sumatra in 2023, there were 1,437 cases of diarrhea in the city of Tebing Tinggi (Badan Pusat Statistik Provinsi Sumatera Utara, 2023).

According to research (Sandika et al., 2019) There is a relationship between beverage handling behavior, water sanitation conditions, and equipment sanitation with the presence of microorganisms *Escherichia coli* on milkshake drinks in the Warungboto Village area, Yogyakarta City. Sanitizing equipment that does not meet standards is one of the factors that increases the risk of bacterial contamination *Escherichia coli* on drinks. Poor handling of drinks can cause illness due to bacterial contamination. Not only that, clean water sources, water supply places, and water conditions must meet the required physical standards. These physical requirements include colorless, odorless, and tasteless.

Research results (Fithria et al., 2022) shows a relationship between the hygiene of the handler and the presence of bacteria *Escherichia coli* on processed drinks in Kendari Beach, Kendari City in 2022. This is due to the bad habits of traders in managing beverage making. One of the factors that causes this is that many traders do not maintain proper hand hygiene before or after completing the beverage making process. Dirty or contaminated hands can be a source of bacterial transmission, including *Escherichia coli*, as well as various other causative agents.

Research results, (Istiani & Agustiani, 2021) further shows that there is a relationship between the hygiene of the handlers and the way of serving food with the presence of microorganisms *Escherichia coli* elementary school children in Sempur Village, Bogor City in 2019. Many traders use serving trays or display cabinets that are not perfectly covered, as well as serving equipment that is not properly cleaned and do not even have a cover. This condition increases the risk of microorganism contamination *Escherichia coli*.

Based on the results of environmental observations on sugarcane iced drink traders in January 2025, 57 traders were found spread across Tebing Tinggi City (Dinas Perdagangan Kota Tebing Tinggi, 2024) Traders use different types of sugarcane grinding machines, such as standing and table types, which are generally made of aluminum. However, most of the process of making cane ice drinks does not meet hygiene and sanitation standards. Some traders do not wash their hands before preparing the drink, which can transmit microorganisms to the drink. In addition, the hygiene of nails, hair, clothing, as well as the habit of smoking

and scratching the body during work also has the potential to increase the risk of cross-contamination. Most traders do not use aprons that are supposed to protect drinks from contamination.

In addition to the hygiene problem of handlers, the cleanliness of the equipment is also a concern. Some traders do not wash sugarcane before grinding, use water that is not changed periodically to wash equipment, as well as litter sugarcane waste, which attracts flies and increases the risk of contamination. The glasses used to serve cane ice are often simply rinsed with soapy water and dried using non-sterile napkins. Some traders even use ice cubes from sources that are not guaranteed cleanliness and do not protect the drink from dust and insects.

This condition is very risky because the consumption of contaminated sugarcane ice can cause health problems, especially due to contamination of pathogenic bacteria such as *Escherichia coli*. These bacteria can cause diarrhea and gastrointestinal infections, which negatively impact public health. This study aims to analyze the relationship between the sanitary hygiene of traders and the presence of *Escherichia coli* in sugarcane ice drinks sold in Tebing Tinggi City.

The introduction should contain (structured) general background, the problem, previous literature review (state of art) as the basis of a statement of the scientific novelty of the article, a statement of scientific novelty, and the research problem or hypothesis. At the end of the introduction should be written the purpose of the article studies. In a scientific article, the format is not allowed for the review of the literature as well as in a research report, but expressed in the previous literature review (state of the art) to demonstrate the scientific novelty of the article and can be written development conceptually based on previous research studies.

Method

This study is a quantitative research with an observational design *cross sectional* carried out in Tebing Tinggi City in January-June 2025 (Abduh et al., 2022). Laboratory examination of samples was carried out at the Medan Public Health Laboratory Center (BLKM). The study population was 57 sugarcane ice drink traders, with a sample of 31 traders and 31 beverage samples determined using the Lemeshow formula for a limited population and technique *stratified simple random sampling*. Sampling is carried out directly in the field by maintaining sterility using *Icebox* temperature ±4°C, then checked using the *Most Probable Number* (MPN) to detect bacteria *Escherichia coli*. The independent variables include sanitary hygiene, touching hygiene, equipment sanitation, and sanitation facilities, while

the dependent variables are the presence of *E. coli*. Primary data were obtained from observations, interviews, and laboratory tests, as well as secondary data from supporting literature. The analysis was carried out univariate and bivariate using the Chi-square (χ^2) test with a significance level of 0.05.

Results

Map of Tebing Tinggi City

Figure 1. Map of Tebing Tinggi City

Respondent Characteristics

Table 1. Distribution of Characteristics of Sugarcane Ice Drink Traders in Tebing Tinggi City

Respondent Characteristics	N	%
Gender		
Man	13	41,9
Woman	18	58,1
Age		
20-24 Years	1	3,2
25-44 Years	19	61,3
45-59 Years	6	19,4
≥ 60 Years	5	16,1
Education Level		
Elementary School	8	25,8
Junior High School	9	29,0
Senior High School	14	45,2
Total	31	100

Based on table 1, most of the respondents were female (58.1%), were in the age group of 25–44 years (61.3%), and had the last level of education in high school/vocational school (45.2%).

Univariate Analysis

Table 2. Distribution of Sugarcane Ice Drink Sanitation Hygiene in Tebing Tinggi City

Hygiene Sanitation	Eligible		Not Eligible	
	N	%	N	%
Selection of Raw Materials	11	35,5	20	64,5
Raw Material Storage	20	64,5	11	35,5
Raw Material Processing	13	41,9	18	58,1
Storage of Finished Beverages	12	38,7	19	61,3
Beverage Transportation	13	41,9	18	58,1
Serving Drinks	17	54,8	14	45,2

Based on table 2, it is known that in the aspect of raw material selection, as many as 11 respondents (35.5%) are eligible, while 20 respondents (64.5%) are not eligible. In the aspect of raw material storage, 20 respondents (64.5%) were eligible and 11 respondents (35.5%) were not eligible. In the aspect of raw material processing, as many as 13 respondents (41.9%) were eligible, while 18 respondents (58.1%) were not eligible.

Meanwhile, in the aspect of storing finished beverages, 12 respondents (38.7%) met the requirements and 19 respondents (61.3%) did not meet the requirements. In the aspect of beverage transportation, as many as 13 respondents (41.9%) met the requirements and 18 respondents (58.1%) did not meet the requirements. Finally, in

the aspect of serving beverages, there were 17 respondents (54.8%) who were eligible and 14 respondents (45.2%) who were not eligible.

Table 3. Frequency Distribution of Sanitary Hygiene Classification

Hygiene Sanitation	N	%
Not Eligible	27	87,1
Eligible	4	12,9
Total	**31**	**100**

Based on table 3, most food handlers performed sanitary hygiene that did not meet the requirements, namely 27 respondents (87.1%). Meanwhile, only 4 respondents (12.9%) carried out sanitation hygiene in accordance with the eligible provisions.

Table 4. Frequency Distribution of Handling Hygiene Classification

Hygiene Toucher	N	%
Not Eligible	22	71
Eligible	9	29
Total	**31**	**100**

Based on table 4, most food handlers have an uneligible level of hygiene, which is as many as 22 respondents (71%). Meanwhile, only 9 respondents (29%) of food handlers who have a level of hygiene are eligible.

Table 5. Frequency Distribution of Equipment Sanitation Classification

Equipment Sanitation	N	%
Not Eligible	19	61,3
Eligible	12	38,7
Total	**31**	**100**

Based on table 5, most of the equipment sanitation facilities are in the category of not eligible, which is as many as 19 respondents (61.3%). Meanwhile, only 12 respondents (38.7%) had eligible equipment sanitation facilities.

Table 6. Frequency Distribution of Sanitation Facility Classification

Sanitation Facilities	N	%
Not Eligible	14	45,2
Eligible	17	54,8
Total	**31**	**100**

Based on table 6, most sanitation facilities are in the eligible category, which is as many as 17 respondents (54.8%). Meanwhile, as many as 14 respondents (45.2%) of the existing sanitation facilities were classified as ineligible.

Table 7. Examination Results *Escherichia coli*

Merchant Sample Code	Results in units MPN/gr	Up to Maximum	Information
P1	16,0	<3.6	TMS
P2	9,2	<3.6	TMS
P3	9,2	<3.6	TMS
P4	9,2	<3.6	TMS
P5	16,0	<3.6	TMS
P6	16,0	<3.6	TMS
P7	9,2	<3.6	TMS
P8	9,2	<3.6	TMS
P9	>23	<3.6	TMS
P10	23,0	<3.6	TMS
P11	2,2	<3.6	MS
P12	<1.1	<3.6	MS
P13	2,2	<3.6	MS
P14	2,2	<3.6	MS
P15	16,0	<3.6	TMS
P16	9,2	<3.6	TMS
P17	2,2	<3.6	MS
P18	2,2	<3.6	MS
Merchant Sample Code	**Results in units MPN/gr**	**Up to Maximum**	**Information**
P19	12,0	<3.6	TMS

P20	12,0	<3.6	TMS
P21	9,2	<3.6	TMS
P22	6,9	<3.6	TMS
P23	2,2	<3.6	MS
P24	2,2	<3.6	MS
P25	9,2	<3.6	TMS
P26	9,2	<3.6	TMS
P27	6,9	<3.6	TMS
P28	6,9	<3.6	TMS
P29	5,1	<3.6	TMS
P30	6,9	<3.6	TMS
P31	6,9	<3.6	TMS

Based on table 7, it was found that as many as 23 samples (74.2%) showed positive results with *Escherichia coli* levels exceeding the maximum permissible limit of <3.6 MPN/gr. The levels *of Escherichia coli* in these positive samples varied, ranging from 5.1 MPN/gr to more than 23 MPN/gr, indicating significant microbiological contamination in the cane ice drinks sold. In contrast, as many as 8 other samples (25.8%) showed negative results with *Escherichia coli* levels below or equal to the maximum permissible limit, which ranged from less than 1.1 MPN/gr to 2.2 MPN/gr.

Table 8. Frequency Distribution *Escherichia coli*

Existence Escherichia coli	**N**	**%**
Not Eligible	23	74,2
Eligible	8	25,8
Total	31	100

Based on table 8, most of the samples showed an Ineligible result (>3.6 MPN/gr) for the presence of Escherichia coli, which was 23 respondents (74.2%). Meanwhile, only 8 respondents (25.8%) showed Eligible results (<3.6 MPN/gr).

Bivariate Analysis

Table 9. The Relationship of Hygiene and Sanitation with Existence *Escherichia coli*

Variabel	**Presence of *Escherichia coli Bacteria***		**N**	**%**	**P-Value**	**PR (95%CI)**
	Not Eligible	**Eligible**				
Hygiene Sanitation						
Not Eligible	22	5	274	87,1	0,043	3,259 (0,591-
Eligible	1	3		12,9		17,964)
Hygiene Mixer						
Not Eligible	19	3	22	71	0,027	1,943 (0,919-
Eligible	4	5	9	29		4,110)
Equipment Sanitation						1,789 (0,995-
Not Eligible	17	2	19	61,3	0,032	3,217)
Eligible	6	6	12	38,7		
Sanitation Facilities						1,579 (1,034-
Not Eligible	13	1	14	45,2	0,045	2,411)
Eligible	10	7	17	54,8		

Based on table 9, the results showed that 87.1% of the cane ice drinks produced by traders with uneligible sanitary hygiene were categorized as ineligible based on the presence of *Escherichia coli* bacteria, compared to only 12.9% in eligible traders.

The results of the analysis showed a significance value of 0.043 (p < 0.05), which means that there is a significant relationship between sanitary hygiene and the presence of *Escherichia coli* bacteria. A Prevalence Ratio (PR) value of 3,259 (95% CI: 0,591-17,964)indicates that merchants with uneligible sanitary hygiene have a 3,259 times higher risk of causing *Escherichia coli* contamination in beverages sold compared to eligible merchants.

Furthermore, as many as 71% of cane ice drinks handled by handlers with uneligible hygiene were categorized as ineligible based on the presence of *Escherichia coli* bacteria, while only 29% were handled by handlers with eligible hygiene showing eligible results. Statistical tests yielded a significance value of 0.027 (p < 0.05), which showed a significant relationship between the hygiene of food handlers and the presence of *Escherichia coli* in sugarcane ice. A Prevalence Ratio (PR) value of 1.943 indicates that handlers with uneligible hygiene have a 1.943 times higher risk of causing *Escherichia coli* contamination compared to eligible handlers.

Furthermore, 61.3% of the beverages processed using uneligible equipment were categorized as ineligible based on the presence of *Escherichia coli* bacteria, compared to 38.7% of the beverages processed using eligible equipment. The results of the analysis showed a significance value of 0.032 (p < 0.05), which showed that there was a significant relationship between equipment sanitation and the presence of *Escherichia coli*. A PR value of 1.789 indicates that the use of uneligible equipment increases the risk of *Escherichia coli* contamination by 1.789 times higher than the use of eligible equipment.

Beverages produced with uneligible sanitation facilities had a *Escherichia coli contamination rate* of 45.2%, while those using eligible sanitation facilities had a contamination rate of 54.8%. Although the percentage appears to be balanced, the results of the statistical test showed a significance value of 0.045 (p < 0.05), which indicates that there is a significant relationship between the condition of sanitation facilities and the presence of *Escherichia coli*. A PR value of 1.579 indicates that an uneligible sanitation facility increases the risk of *Escherichia coli* contamination by up to 1.579 times compared to an eligible facility.

Discussion

Escherichia coli *Test Results*

The results of the examination of 31 samples of sugarcane ice drinks sold by traders in Tebing Tinggi City showed that most of the samples, namely 23 samples (74.2%), were categorized as ineligible

because they were contaminated with *Escherichia coli* with levels exceeding the maximum permissible limit, which was <3.6 MPN/gram. *Escherichia coli* levels in these uneligible samples varied from 5.1 MPN/gram to more than 23 MPN/gram, indicating the presence of significant microbiological contamination.

Meanwhile, only 8 samples (25.8%) were categorized as eligible, with *Escherichia coli* levels at or below the safe limit, which is between <1.1 MPN/gram to 2.2 MPN/gram. The high proportion of uneligible samples shows that most traders have not implemented adequate hygiene and sanitation standards in the processing, storage, and serving of sugarcane iced drinks. Factors such as unhygienic water use, unclean equipment, cleanliness of the environment around the place of sale, and low awareness of traders on the importance of personal hygiene are suspected to be the main causes of the high level of microbiological contamination.

The Relationship of Hygiene and Sanitation with the Presence of Escherichia coli

The results showed that of the 27 samples of sugarcane ice drinks produced by traders with uneligible sanitary hygiene, as many as 22 samples (87.1%) were categorized as ineligible based on the presence of *Escherichia coli* bacteria. Meanwhile, of the 4 samples from traders with eligible sanitary hygiene, only 1 sample (12.9%) was categorized as incompetent. Statistical tests showed a significance value of 0.043 ($p < 0.05$), which indicated a significant relationship between the sanitary hygiene of traders and the presence of *Escherichia coli* in sugarcane ice drinks.

A Prevalence Ratio (PR) value of 3.259 with a 95% confidence interval (0.591-17.964) indicates that uneligible sanitary hygiene increases the risk of Escherichia coli contamination by up to 3.259 times greater than eligible sanitary hygiene. This emphasizes the importance of implementing good and consistent sanitary hygiene in all stages of processing and serving beverages.

This research is in line with research (Hadiyati et al., 2023) at the Snack Food Center in Jambi City found that traders with inappropriate food hygiene and sanitation had levels of contamination *E. coli* which is much higher than traders who apply good hygiene standards. The results of the Chi-square test showed $p = 0.001$ and an odds ratio of about 8.8 (95% CI: 2.4–32.2), which means that traders with poor sanitation practices are almost 9 times more likely to be exposed to microbial contamination.

Based on the results of observations in the field, it is known that in the aspect of raw material selection, most traders

(64.5%) are not eligible, which indicates low attention to the quality of the initial materials used. On the other hand, the raw material storage aspect showed better results, where 64.5% of traders were eligible, indicating an effort to maintain the quality of materials during storage. However, in the aspect of raw material processing, the majority of traders (58.1%) have not met the set standards, thus increasing the risk of contamination during the production process.

Likewise, in the aspect of storing finished beverages, 61.3% of respondents did not Eligible, indicating that final storage is still a critical point in the sanitary hygiene chain. The aspect of transporting beverages also showed similar results, with 58.1% of traders not yet eligible, indicating potential exposure to pollution during the distribution process. Nonetheless, the beverage presentation aspect showed relatively better results, where 54.8% of merchants were eligible. Although this figure is higher than other aspects, there are still 45.2% of traders who have not maintained cleanliness and safety in their presentation, which remains an important concern in preventing contamination of sugarcane iced drinks.

The Relationship of Hygiene of Handlers with the Presence of Escherichia coli

Based on the results of a study in Tebing Tinggi City, it was found that of the 22 samples of sugarcane ice drinks handled by handlers with uneligible hygiene, as many as 19 samples (71%) were categorized as ineligible based on the presence of *Escherichia coli* bacteria. Meanwhile, of the 9 samples handled by handlers with eligible hygiene, only 4 samples (29%) were categorized as uneligible. The results of the statistical analysis showed a significance value (p-value) of 0.027 ($p < 0.05$), which indicates a significant relationship between the hygiene of the handlers and the presence of *Escherichia coli* in sugarcane ice drinks.

A Prevalence Ratio (PR) value of 1.943 with a 95% confidence interval (0.919-4.110) indicates that handlers with uneligible hygiene have a 1.943 times higher risk of causing *Escherichia coli* contamination in sugarcane ice compared to handlers with good hygiene. This shows that the hygienic condition of the handlers plays an important role in maintaining the microbiological safety of the drinks served.

The results of this study are in line with those that state that the hygiene of individual food handlers has a significant relationship with the existence of *Escherichia coli* on managed foods, with a value of *p-value = 0.038.* (X et al., 2021) Literature review also supports these findings, with most of the studies they reviewed showing a link between the personal hygiene of food handlers and the

level of contamination of pathogenic microorganisms (Dewi & Porusia, 2022).

Research by Alfarida and Wulandari also reinforces this, confirming that inadequate hygiene practices, including improper water use and unhygienic equipment, are significantly correlated with an increased risk of contamination *Escherichia coli* on drinks, based on literature that shows a range of values *p-value* between 0.01 to 0.05 (Kesehatan Masyarakat Fakultas Ilmu Kesehatan & Hindira Alfarida, 2023).

These findings indicate that many handlers still lack attention to hygiene standards such as washing their hands before touching food, wearing gloves, and keeping the equipment clean. Cross-contamination can occur when handlers hold raw materials or unclean equipment and then directly touch ice or beverages without washing their hands first. In addition, improper water consumption and unclean washing of glasses or beverage containers are also factors that trigger the presence of *Escherichia coli* in sugarcane ice.

The Relationship of Equipment Sanitation with the Presence of Escherichia coli

Based on the results of the study, it is known that of the 19 samples of sugarcane ice drinks processed using equipment that did not meet sanitary requirements, as many as 17 samples (61.3%) were categorized as ineligible based on the presence of *Escherichia coli* bacteria. In contrast, of the 12 samples processed using sanitation-eligible equipment, only 6 samples (38.7%) were categorized as unsuitable. The results of the statistical test showed a significance value of 0.032 ($p < 0.05$), which showed a significant relationship between equipment sanitation and the presence of *Escherichia coli* in sugarcane ice drinks.

A Prevalence Ratio (PR) value of 1,789 with a 95% confidence interval (0,995-3,217) indicates that the use of equipment that does not meet sanitary standards has an 1,789 times higher risk of causing *Escherichia coli* contamination compared to the use of equipment that has met sanitary standards. This shows that the cleanliness and condition of the equipment used in the beverage processing process plays an important role in preventing microbiological contamination.

This study is in line with findings that show a significant relationship between equipment sanitation and presence *Escherichia coli* on school children's snack food. In the study, statistical tests produced a $p = 0.021$ ($p < 0.05$), which indicates that poor sanitary conditions of the appliance contribute significantly to the level of microbiological contamination.(Syafriyani & Djaja, 2020) Similar findings were also

found in a literature review which concluded that of the three journals analyzed, one showed a strong relationship between equipment sanitation and contamination *Escherichia coli,* with a value of *p-value* significant by *0,034* (Kesehatan Masyarakat Fakultas Ilmu Kesehatan & Hindira Alfarida, 2023)

From the observation results, it was found that some handlers did not wash utensils such as cups, spoons, and drink lids with clean running water, but only soaked them in the same container. This habit has the potential to cause the transfer of microorganisms from one appliance to another. In addition, the lack of use of laundry soap and the absence of proper drying of the equipment after washing also increase the risk of bacterial growth.

Poor equipment sanitation often goes unnoticed in the management of food and beverage hygiene. In fact, unhygienic equipment can be a major source of contamination that endangers consumer health

The Relationship of Sanitation Facilities with the Presence of Escherichia coli

The results showed that of the 14 samples of sugarcane ice drinks produced using uneligible sanitation facilities, as many as 13 samples (45.2%) were categorized as ineligible based on the presence of *Escherichia coli* bacteria. Meanwhile, of the 17 samples produced with eligible sanitation facilities, there were 10 samples (54.8%) that also showed ineligible results based on the presence of *Escherichia coli bacteria*. Although the percentage results appear to be fairly balanced, the results of the statistical test showed a significance value of 0.045 ($p < 0.05$), which indicates a significant relationship between the condition of sanitation facilities and the presence of *Escherichia coli* in sugarcane ice drinks.

A Prevalence Ratio (PR) value of 1,579 with a 95% confidence interval (1,034-2,441) indicates that the use of uneligible sanitation facilities is 1,579 times higher risk of causing *Escherichia coli contamination* compared to facilities that meet sanitation standards. Although the lower limit value of the confidence interval is close to 1, this relationship is still considered statistically significant, so it is important to pay attention to it in food processing practices.

This research is in line with the findings of research in Sukoharjo,(Nurbaya et al., 2023) which suggests that the condition of uneligible sanitation facilities has a significant relationship with increased presence *Escherichia coli* in the beverage products sold. The results of the statistical test showed a significance value of $p = 0.015$, which indicated a strong relationship between the quality of sanitation facilities

and the risk of microbiological contamination (Nurbaya et al., 2023).

In addition, a similar study conducted in Lusaka, Zambia (2022),(Chua et al., 2022) also emphasized the importance of sanitation facilities in preventing contamination *Escherichia coli*. In the context of the household environment, it was found that the use of improper sanitation facilities such as pit latrine, inadequate washing water flow, and poor sewage disposal systems also contribute to increased contamination *E. coli* on drinking water and tableware.

In field observations, it was found that some sugarcane ice production sites do not have adequate access to clean water or use unprotected water to wash materials and equipment. Some places also do not provide a dedicated place for liquid waste disposal, so used laundry water is left to stagnate and potentially become a source of cross-contamination.

Conclusions

Based on the results of data analysis regarding the relationship between sanitary hygiene and the presence of *Escherichia coli* bacteria in sugarcane ice drinks sold in Tebing Tinggi City, it can be concluded as follows:

1. The results of the study in Tebing Tinggi City, as many as 23 samples (74.2%), were categorized as ineligible because they contained *Escherichia coli* exceeding the maximum permissible limit (>3.6 MPN/gram). Meanwhile, only 8 samples (25.8%) were eligible with *Escherichia coli* levels below safe limits (<3.6 MPN/gram).
2. There was a significant relationship between sanitary hygiene and the presence *of Escherichia coli* in sugarcane ice drinks (p = 0.043; PR = 3,259; 95% CI: 0,591-17,964). Uneligible sanitary hygiene increases the risk of contamination.
3. There was a significant relationship between handler hygiene and the presence of *Escherichia coli* in sugarcane ice drinks (p = 0.027; PR = 1,943; 95% CI: 0,919-4,110). Touchers who do not meet hygiene requirements have a higher risk of causing bacterial contamination.
4. There was a significant association between equipment sanitation and the presence *of Escherichia coli* in cane ice drinks (p = 0.032; PR = 1,789; 95% CI: 0,995-3,217). Unclean equipment increases the risk of bacterial contamination.
5. There was a significant association between sanitation facilities and the presence *of Escherichia coli* in sugarcane ice drinks (p = 0.045; PR = 1,579; 95% CI: 1,034-2,411). Inadequate sanitation facilities

contribute to an increased risk of contamination.

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