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SANITATION PRACTICES AND ESCHERICHIA COLI CONTAMINATION IN SUGARCANE ICE: A CASE STUDY FROM 16 ILIR MARKET IN PALEMBANG

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ABSTRACT

Sugarcane ice is a beverage susceptibleto be contaminated with bacteria such as E.coli from the processing stage to the final stage of serving. This study aimed to analyze the sanitary hygiene practices and E. coli content in sugarcane ice sold at 16 Ilir Market, Palembang. The method used was descriptive qualitative through observational research. There were 12 informants selected by purposive sampling and eight samples consisting of 4 samples of sugarcane ice and four samples of water used by the handlers. Laboratory results on sugarcane ice showed that 3 of the four samples tested were positive for E.coli, with 6.9 MPN/100 ml results and 1.1 MPN/100 ml. As for the water used by the handlers, all were detected negative for E.coli. The results showed that two handlers did not always wash their hands before processing sugarcane ice, and all handlers did not use special tools to take sugarcane stalks. 3 out of 4 servers still use water containers from disposable plastic containers, two servers do not have trash bins, and three servers have open sugar cane storage. The conclusion was that sugar cane ice's sanitary hygiene was still not good, and E.coli bacteria were found in sugar cane ice. The advice is that the server must be able to maintain personal hygiene, the cleanliness of the processing equipment used, and the cleanliness of the environment around the selling place to keep it clean.

Keywords: escherichia coli, sugarcane ice, sanitary hygiene

Introduction

Producers and consumers must prioritize the consumption of safe food and beverages while enhancing awareness of food safety. According to Government Regulation No. 86/2019, food safety is crucial for preventing contamination in food, whether biological, chemical, or physical, that can harm human health. Food contamination occurs when unintentional or unwanted substances enter food or beverages, rendering them unsafe for consumption.[3]

According to the WHO, improperly managed beverages are at risk of spreading various diseases, such as diarrhoea, dysentery, and other illnesses, leading to contamination of these beverages. Additionally, poor sanitation and inadequate personal hygiene contribute to the risk of diarrhoea and other diseases.[4] he South Sumatra Provincial Health Office reported that in 2022, the number of diarrhoea incidents in Palembang City was 25,356 cases, a decrease from 30,318 cases in the previous year, 2020.[5] Contamination in beverages poses a significant health threat, as many consumers are unaware of the safety, quality, and cleanliness of the beverages they consume. One type of beverage that is particularly at high risk of contamination is those sold on the roadside.[6]

Sugarcane ice is one of the many beverages sold on the roadside or in crowded places. This sweet and refreshing drink is typically sold using a cart equipped with a sugarcane grinding machine that serves as a juicer and is traditionally served in a glass or plastic bag.[7] The preparation of this beverage is straightforward; however, the risk of contamination by bacteria such as E. coli is heightened from the production stage to the final serving to consumers.[8]

Research conducted by Simanjuntak found that of the 30 sugarcane water samples tested, all contained E. coli bacteria, with an average E. coli content of 529.00 (±762.17) MPN/100 ml.[9] E. coli is a type of biological contamination that can endanger human health, as its presence is commonly found in food or beverages that are not stored and processed correctly, making it a significant health risk. E. coli contamination in sugarcane ice can be attributed to several factors, namely hygiene and sanitation. Hygiene factors relate to the personal hygiene of sugarcane ice handlers, while sanitation factors encompass various aspects, such as the quality of water, cleanliness of selling carts, and processing equipment.

Environmental conditions can significantly impact the community, and many diseases originate from environmental factors.[10] Several studies on the same topic have found that, on average, sugarcane juice contains E. coli bacteria, regardless of whether the research location is on the side of the highway or in a traditional market[7,11,12]. In this study, the researcher chose the 16 Ilir market as the location. The 16 Ilir market is situated at Jalan Pasar 16 Ilir No. 53, East Ilir, Palembang City, South Sumatra, 30111. The north side leads to the Musi River, the south side leads to a wet alley, the west side leads to the Ampera Bridge, and the east side leads to Jalan Sayangan.

The 16 Ilir market is located very close to tourist attractions, namely the Ampera Bridge and the Kuto Besak Fort Museum, making it a bustling area filled with food and beverage vendors. Numerous beverage traders line the road, including those selling sugarcane juice. The sugarcane juice sold along the market road is prone to bacterial contamination due to poor environmental sanitation and inadequate hygiene practices among the vendors. To date, no study has observed the bacterial content of sugarcane juice at this location, which has piqued the interest of researchers. Therefore, the aim of this research is to determine the E. coli content in sugarcane ice and to analyze the sanitation and hygiene practices of sugarcane ice vendors at 16 Ilir Market Street, Palembang.

Methods

This research employed a descriptive qualitative methodology with an observational study approach. The research period commenced in April 2023 and concluded in June 2024. The study was conducted in two locations: 16 Ilir Market Street, Palembang, and the Technical Centre for Environmental Health and Disease Control Class I, Palembang. Sugarcane ice sampling, interviews with informants, and field observations were carried out at 16 Ilir Market Street, Palembang, within a maximum distance of 250 meters from the entrance, focusing on vendors who used a wheelbarrow for selling, were permanently stationed (not moving from place to place), and had a trademark. Meanwhile, Escherichia coli bacteria were analyzed in the samples at the Environmental Health and Disease Control Technical Centre (EHDCTC) Class I, Palembang.

The research informants were selected using purposive sampling and divided into two types: key informants and supporting informants. The key informants consisted of four individuals, including sugarcane ice traders who met the following criteria: selling in the area around 16 Ilir Market Street, Palembang; using a pushcart that was permanently stationed to sell sugarcane ice; processing and serving sugarcane ice directly; and being willing to be interviewed. As for the supporting informants, there were eight individuals consisting of sugarcane ice buyers who met the following criteria: having purchased sugarcane ice more than two times and being willing to be interviewed. Information sought from the informants included the sanitation of the water used by sugarcane ice traders, the condition of the selling carts, the cleanliness of the equipment used, and the hygiene of the handlers.

The data required for this study were collected through in-depth interviews, observations, and laboratory tests. During the in-depth interviews, we were assisted by interview guidelines that contained information about food hygiene and sanitation. In conducting observations, the researchers used standard observation instruments based on the Minister of Health's Regulation Number 942. This process helped ensure objective analysis and prevented researcher bias in the

research results. The testing of bacterial content in sugarcane juice was carried out at the EHDCTC Class I, Palembang.

The samples used in this study consisted of eight samples collected from four key informants, with each key informant providing two types of samples: one sample of clean water used and one sample of sugarcane ice sold. Each sample was taken in approximately 400 ml (1 glass), placed in a sterile container, and stored in an ice box to maintain a cold temperature during transport to the testing laboratory. Laboratory tests were conducted over eleven days to identify the presence of Escherichia coli bacteria in the samples. If E. coli was detected, the sugarcane ice sample (MPN/100 ml) was considered positive; if the result was zero, it was considered negative.

Data processing and analysis were conducted according to the reference standards outlined in the Decree of the Minister of Health of the Republic of Indonesia Number 942/Menkes/SK/VII/2003 concerning Guidelines for Hygiene Sanitation Requirements for Street Food. To ensure the validity of the research results, the researchers employed triangulation methods through in-depth interview techniques, observations, and laboratory tests. The interview data that had been collected were then analyzed through data reduction. Furthermore, after the data was reduced, the findings were presented in the form of narrative texts from in-depth interviews and tables of laboratory test results.

Results

Based on the data obtained, Table 1 shows that the raw material for sugarcane stalks used by sugarcane ice traders is sourced from different places. Food handlers A and ES obtain sugarcane from a regular distributor who typically travels around using a pick-up truck. They usually purchase sugarcane every 2-3 days, depending on the availability of their remaining stock. Meanwhile, food handlers DA and D source their sugarcane stalks from plantations in the Palembang area, depending on the type of sugarcane and the agreed price. Like A and ES, they also typically buy sugarcane every 2-3 days, based on the availability of their remaining stock.

Table 1. Characteristics of Key Informants (Beverage Handlers)

Initials	Age	Gender	Jobs	Length of time in business	Open-Close Hours	Origin of Raw Materials
A	43 years old	Male	Food handlers	7 years	10.00-17.30	Mariana/Tegal Binangun
DA	36 years old	Women	Food handlers	7 years	10.00-17.00	Not necessarily
ES	37 years old	Women	Food handlers	6 years	08.00-18.00	Originally from Padang
D	53 years old	Male	Food handlers	4 years	10.00-17.00	Kenten/Sukabangun

Supporting informants, as shown in Table 2, are consumers of sugarcane juice. They consist of local traders and students who typically purchase sugarcane juice at the 16 Ilir market. The average age of the supporting informants is 35.75 years, with the youngest being 16 years old and the oldest being 49 years old. Seven of the eight supporting informants are female.

Table 2. Characteristics of Supporting Respondents (Consumers)

Initials	Age	Gender	Jobs
AD	42 years old	Male	Merchants
YN	29 years old	Women	Merchants
R	36 years old	Women	Merchants
AL	16 years old	Women	Student/Merchant
K	42 years old	Women	Merchants
YL	32 years old	Women	Merchants
DH	49 years old	Women	Merchants
DS	40 years old	Women	Merchants

"Based on interviews with key informants, specifically beverage servers, regarding the origin of the clean water sources they use daily, two informants stated that the water used for daily sales comes from tap water supplied by the Regional Drinking Water Company (RDWC) and is taken from the market's public toilet. In contrast, the other two informants indicated that the source of clean water they use comes from boiled water and RDWC that is brought directly from home. The results of the interviews with key informants are as follows:

"from that public washroom, under the Ampera" (A)

"from the public washroom here" (DA)

"from the ice cube that melted and took the water from there" (ES).

"from the RDWC, brought from home" (D).

Based on the results of interviews with key informants regarding the water storage containers used by handlers, two informants stated that they store the water in disposable water-gallon containers. The other two informants store the water in 1.5-liter water bottles and ice cube thermoses. The results of the interviews with key informants are as follows:

"use the le mineral (gallon) sometimes the bucket, but it breaks" (A)

"It's in the big aqua bottle" (DA)

"Find a special place, put it in an ice bucket, then move it to the bucket" (ES).

"inside that gallon" (D).

In addition, based on the results of interviews with supporting informants regarding the use of disposable water containers by sugarcane ice traders, two supporting informants stated that the water containers used by sugarcane ice traders were disposable, while one informant indicated that the containers used were not disposable. Another informant responded that he did not know. The results of the interviews with key informants are as follows:

"Well, I don't know, he used to use gallons, he used to use jerry cans for oil." (YN)

"Yes, she uses an aqua bottle, doesn't she? Maybe she doesn't have a container again, so she uses that, but she always washes it so it's always clean" (R).

"No, the water container is combined with the ice cube container, so it's not used" (YL).

"Yes, because he used the gallon of le mineral that he had to dispose of once" (DS).

The interviews with key informants, supporting informants, and observations revealed that three out of four beverage servers use clean water sourced from the Regional Drinking Water Company (RDWC). One server does not have a specific container for storing water, while three servers use disposable plastic water containers.

Table 3. Cleanliness of the water used

Description	Key Informants							
	A		DA		ES		D	
	Yes	No	Yes	No	Yes	No	Yes	No
CLEANLINESS OF THE WATER USED								
There are clean water source facilities.	√		√		√		√	
Specialized containers for storing water are available.	√		√			√	√	
Water storage containers are clean.	√		√		√		√	
Closed water storage containers.	√		√		√		√	
Water storage containers are not disposable containers.		√		√	√			√
Water is used to wash equipment.	√		√		√		√	
Water is used to wash raw materials.	√			√		√	√	
Water used for hand washing.	√		√		√		√	

Based on the results of interviews with key informants regarding where traders usually place the waste from processing sugarcane ice, two informants stated that they had bins in the form of sacks for disposing of the waste from processing sugarcane stalks. In contrast, two other informants indicated that they did not have bins for the waste, so it was placed under or next to the selling carts. The results of the interviews with key informants are as follows:

"There are put inside that sack every time it has been milled, in the afternoon someone will pick it up" (A).

"There (under the cart) in the afternoon there are people taking it, near the rubbish bin" (DA).

"If there is rubbish, I throw it in front (in a sack) when there is a rubbish man" (ES).

"nothing, so just put in front of there, in the afternoon someone will pick it up" (D).

Based on the results of interviews with supporting informants regarding the availability of trash bins for sugarcane ice traders, two informants stated that these traders provide trash bins to accommodate the sugarcane dregs after grinding. In contrast, the other two informants indicated that sugarcane ice traders do not have the necessary trash bins. The results of the interviews with supporting informants are as follows:

"bins are provided, every time the mill is finished the waste is put in sacks" (AD).

"bins should be provided" (R)

"there is a bin so that it doesn't splash from the sack" (K).

"There are rubbish bins, but in the afternoons there are people who take the cleaners" (DS).

Based on the results of interviews with key informants regarding where traders usually wash their equipment, hands, and raw materials, two informants stated that they wash everything in the same place. The other two informants indicated that they wash the raw materials at home before selling them at the market. The results of the interviews with key informants are as follows:

"this is where this bucket of all" (A)

"washing cane at home, here for washing hands and equipment" (DA)

"Sugar cane is washed at home, mostly here we wash the tools and wash our hands" (ES).

"all here, at the market" (D)

The results of interviews with key informants, supporting informants, and observations revealed that two beverage handlers did not have a trash can, and none of the handlers had a designated place to wash their raw materials and hand.

Table 4. Cart Condition

Description	Key Informants							
	A		DA		ES		D	
	Yes	No	Yes	No	Yes	No	Yes	No
CART CONDITION								
Easy to clean	√		√		√		√	
Rubbish bins available	√			√	√			√
There is a place to wash raw materials		√		√		√		√
There is a place to wash equipment	√		√		√		√	
Handwashing stations available		√		√		√		√
EQUIPMENT CLEANLINESS								
Sugarcane grinding machine in a clean state	√		√		√		√	
The machete is clean	√		√		√		√	
Sugarcane sieve in a clean state	√		√		√		√	
Equipment that has been used is washed with clean water	√		√		√		√	
Utensils that have been used are washed under running water		√		√		√		√
Used utensils are washed with soap		√		√		√		√
The equipment is dried with a clean dryer/wipe.		√		√		√		√
Equipment stored in dedicated storage areas		√		√		√		√
Available space for raw material storage	√		√		√		√	
Sugarcane stalk storage bins are easy to clean	√		√		√		√	
The Sugarcane stalk storage area is clean	√		√		√			√
Closed storage of sugarcane stalks		√		√		√		√
Easy-to-clean ice cube storage bin	√		√		√		√	
The ice cube storage area is clean	√		√		√		√	
Storage for finished/ready-to-serve drinks available		√		√		√		√
Not reusing equipment designed for single use only	√		√		√		√	

Based on the results of interviews with supporting informants, it was stated that the sieve used by sugarcane ice traders is crusty in certain parts due to frequent use. When asked about the condition of the sugarcane sieve, the informants confirmed that it is indeed crusty. The results of the interviews with supporting informants are as follows:

"There is a little crust on the nets because they have been used for a long time, but they are still clean" (YN).

"It's a bit crusty because it's used for filter all the time, but it's cleaned up again" (R).

"It's only on the walls because it's often used, but it's clean" (YL).

"Yes, it works in the filter because it is often used, but it is always cleaned" (DH).

From the interviews with key informants regarding whether the raw material storage area is closed, all key informants stated that they store raw materials, such as sugarcane stalks, in an open display case. However, one key informant added that the cut sugarcane stalks are stored in a closed ice box. The results of the interviews with key informants are as follows:

"the sugarcane display case is always open for sure, wherever it is" (A).

"yes, always open, the sugarcane are long so can not fit if it is closed" (DA)

"yes open, because it is open usually to make it easy to take" (ES).

" If the cane has not been cut, he puts it in the container, but if it has been cut, he puts it directly in this ice box " (D)

From the interviews with supporting informants regarding whether the containers used to store sugarcane stalks are closed, three informants stated that the containers are open. In contrast, one informant indicated that they are closed. The results of the interviews with supporting informants are as follows:

"No, the container is open, so people can see whether the condition of the sugarcane is good or not (AD)

"no, the container's glass is open, so that easy to take it, maybe" (R)

"No, the container is open, so the people can see how the sugarcane looks like" (K)"Some are open, some are closed, but the ones that are ground are the ones that are stored in the ice box." (DS)

Based on the results of interviews with supporting informants regarding the condition of the containers used to store sugarcane stalks, three informants stated that the containers used to store sugarcane stalks were clean. In contrast, one other informant indicated that they were not clean. The results of interviews with supporting informants are as follows:

"It's clean, if it's like this, it's usually dust, but every morning it's cleaned and every afternoon" (AD).

"In the morning, I wipe it first so it's clean" (R).

"wipe it clean" (K)

"maybe it is not clean enough" (DS)

The results of interviews with key informants, supporting informants, and observations revealed that three handlers had open cane storage containers, and one handler's cane storage container was not clean. In addition, all the filters used by the handlers were crusted on the inside.

Table 5. Personal Hygiene of Food Handler

Description	Key Informants							
	A		DA		ES		D	
	Yes	No	Yes	No	Yes	No	Yes	No
HANDLER HYGIENE								
Keeping clothes clean	√		√		√		√	
Wearing a head covering	√		√		√		√	
Maintain hand hygiene	√		√		√		√	
Routinely wash hands before processing beverages	√		√			√		√
Wear special tools/equipment when picking up raw materials		√		√		√		√
No chatting or conversing while processing drinks	√		√			√	√	
Not suffering from infectious diseases, e.g. cough, cold, influenza, diarrhoea, stomach diseases, etc.	√		√		√		√	
Not cough or sneeze in the presence of the beverage being prepared.	√		√		√		√	

**Key Informant written by Initial Name*

Based on the results of interviews with key informants regarding how often they wash their hands before processing beverages, two informants stated that before grinding sugarcane, they always wash their hands first, while the other two informants only wash their hands when under certain conditions, such as after handling objects. The results of interviews with key informants are as follows:

"every time you grind, wash your hands" (A)

"When you grind, wash your hands first" (DA)

"If you don't hold anything, you don't wash it, if for example after holding something, you wash your hands" (ES).

"yes sometimes" (D)

Based on the results of interviews with supporting informants regarding the use of special tools by sugar cane ice traders when taking raw materials, all informants stated that sugar cane ice traders do not use special tools when taking raw materials. The results of interviews with supporting informants are as follows:

"nothing, use hand only" (YN)

"If holding the cane never wear gloves, i guess" (AL)

"no, she only hold it by the hands" (K)

"no, take it directly by the hands" (DH)

Based on the results of interviews with supporting informants regarding other activities carried out by sugar cane ice traders while processing sugar cane ice, three informants stated that there were no other activities carried out by sugar cane ice traders when they were about to process sugar cane ice. In contrast, one other informant stated that sugar cane ice traders carried out different activities, such as chatting while processing sugar cane ice. The results of interviews with supporting informants are as follows:

"I don't talk to the customers" (AD).

"No, she is focus" (R)

"It's just chit chat, depends anyway" (K)

"no, he does not talk" (DS)

The results of interviews with key informants, supporting informants, and observations revealed that two handlers only sometimes washed their hands before processing sugar cane ice, one handler chatted while processing sugar cane ice, and all handlers did not use special tools to collect raw materials.

Table 6. Laboratory Results of E.coli Bacteria Content Test on Sugarcane Ice

Sample Code	Inspection Result	MPN/100 ml *E.coli*
P1	Positive	6,9
P2	Positive	6,9
P3	Positive	1,1
P4	Negative	0

Based on the table above, the results of the examination of E. coli bacteria in sugar cane ice at 16 Ilir Market Street Palembang show that 3 out of 4 food handlers have positive results containing E. coli, and only 1 has negative results. Meanwhile, examining E. coli bacteria in clean water at 16 Ilir Market Street Palembang shows that all traders have negative results containing E. coli.

Discussion

Based on the results of research on the sanitation of water used, it is evident that all sugarcane ice sellers still need to fulfill the health requirements for water sanitation as stipulated by the Regulation of the Minister of Health of the Republic of Indonesia No. 32 of 2017 concerning Environmental Health Quality Standards and Water Health Requirements for Sanitary Hygiene Purposes, Swimming Pools, Solus Per Aqua, and Public Baths.[13]

From the observations, it was found that three sugarcane ice servers used water containers made from disposable plastic. They utilize single-use plastic gallons to hold the water used daily; however, these gallons are not recommended for repeated use as they can pose new health hazards. Plastic bottles commonly used for single-use drinking water are made of Polyethylene Terephthalate (PET). When these bottles are reused, chemicals such as antimony and bisphenol A (BPA) can leach into the water, especially if the bottles are exposed to high temperatures. Antimony is a heavy metal that can cause health problems such as lung and heart issues and increase the risk of cancer with long-term exposure. BPA, which is often found in various plastic products, has been linked to hormone disruption, fertility problems, and several other chronic diseases.[14]

Based on the results of the study regarding the condition of the carts, it is evident that all sugarcane ice handlers have not fulfilled the requirements set by the Decree of the Minister of Health of the Republic of Indonesia Number 942/MENKES/SK/VII/2003 concerning Guidelines

for Sanitary Hygiene Requirements for Snack Food.[15] Observations of the sugarcane ice vendors revealed that two vendors did not have waste bins, resulting in the dregs from the sugarcane milling being thrown under the cart. The other two vendors had open bins in the form of sacks. This study is similar to Sulemi's research, which found that out of five sugarcane ice vendors, only some used small plastic bins, while others did not have any bins, leading to garbage being thrown into the ditch near the seller.[8]

There is a relationship between the environment where respondents sell and food sanitation (POR = 6.240). This indicates that traders with poor environmental conditions are 6.2 times more at risk of being unhygienic. Garbage scattered around the merchandise makes the environment appear dirty and unclean. Piles of garbage lead to the breeding of flies, cockroaches, insects, and rats. Another important factor is air circulation and light intensity. If the environmental sanitation conditions are good, the quality of the food produced is guaranteed to be safe and healthy.[16]

Based on the results of research on equipment cleanliness, it is evident that sugarcane ice handlers do not meet the requirements set by the Decree of the Minister of Health of the Republic of Indonesia Number 942/MENKES/SK/VII/2003 concerning Guidelines for Sanitary Hygiene Requirements for Snack Food.[13] One server's sugarcane stalk storage container is in a less clean condition, as it is not only used to store sugarcane stalks but also other equipment such as straws, plastic cups, and other trade items. Additionally, the condition of the container is dirty and messy because the handler rarely cleans it. This study is similar to Lestari's research, which found that all uncovered sugarcane storage areas among the five sugarcane water sellers studied are not clean.[17] After being peeled and stored in unhygienic carts without covers, sugarcane can be contaminated by microorganisms attached to the surface of the cart and by dust in the air.[18]

According to research by Lestari, closed containers are the best place to store sugarcane. They help keep animals and insects away from the sugarcane stalks, as it is known that this plant has a sweet taste, which attracts flies and ants.[17] The increase in the germ population that contaminates sugarcane water during beverage processing is likely due to the large number of flies that settle on sugarcane stored in open containers.[12]

Based on the results of research on the hygiene of beverage handlers, it is evident that all four handlers do not meet the hygiene requirements for beverage handlers as stipulated by the Decree of the Minister of Health of the Republic of Indonesia Number 942/MENKES/SK/VII/2003 concerning Guidelines for Sanitary Hygiene Requirements for Snack Food.[15] The results of interviews with beverage handlers, consumers, and observations revealed that all handlers did not use special tools to handle sugarcane stalks. Using tools when taking raw materials can reduce direct contact between the handler's hands and the drink. This study is similar to Fauzi's research, which found that all sugarcane ice traders hold sugarcane stalks and squeeze them without using gloves, allowing microbes on their hands to transfer to the sugarcane water.[18] Hadi's research

results show that the food equipment used by traders contains more than 100 colonies/cm of Coliform. This contamination is likely due to food equipment such as glasses, bowls, and cups being stored in a stacked manner. Additionally, most traders do not wash their hands with soap, using only water instead.[19] These bacteria can contaminate food during processing and increase the number of germs in the food.[20]

The results also showed that one beverage handler chatted while processing drinks. This study is similar to Napitupulu's research, which found that all sweetmeat sellers, totaling six individuals, have the habit of talking in front of food directly and do not use masks to cover their mouths and noses.[21] According to Hidayati's research, the poor attitude of food handlers is influenced by their working habits, and the environment serves as a supporting factor. Handlers should not be allowed to chat during food processing because saliva can splash onto the food and contaminate it.[22]

Based on the laboratory test results, three of the four sugarcane ice samples tested positive for Escherichia coli bacteria, with results of 6.9 MPN/100 ml and 1.1 MPN/100 ml. These results do not meet the health requirements for consumption, as they contain more than 0 MPN in 100 ml of the sample, according to the reference of the Minister of Health of the Republic of Indonesia No. 492/Menkes/Per/IV/2010 concerning drinking water quality.[23]

Based on observations in the field, it was found that the sugarcane stalk storage area used by one beverage server, which tested positive for E. coli, was different from the raw material storage areas used by three other beverage servers. The three servers store sugarcane stalks in an open display case on a cart or in a location with selling conditions not far from road access, which puts them at risk of contamination with pathogenic bacteria. This differs from the storage method used by the other handler, who employs an ice box to store sugarcane stalks before they are processed into sugarcane ice. An ice box is a closed container used to store and maintain the temperature of an object to keep it cold.

The use of tools that are not sterilized beforehand can increase bacterial contamination. In addition, the tools used are often stored and left unattended after use, which increases the risk of contamination by pathogenic bacteria.[24] One of the essential extrinsic factors that affect the development of microorganisms is temperature. The ideal temperature for the growth of pathogenic bacteria ranges from 10˚C to 60˚C. Low temperatures do not kill bacteria; they only make them inactive, and the bacteria will become active again if environmental conditions allow for their growth and development.[25]

In addition to the sugarcane ice samples, water samples used by the handlers were also investigated. Based on the results of laboratory tests, it was found that all four clean water samples tested negative for Escherichia coli bacteria and met health requirements, as they contained 0 CFU in 100 ml of the sample, according to the Decree of the Minister of Health of the Republic of

Indonesia No. 02 of 2023 concerning Environmental Health Quality Standards for Hygiene and Sanitation purposes.[26]

Sugarcane juice is a sweet drink that undergoes several processing steps. Overall, the results of observations related to the hygiene and sanitation of sugarcane juice can be said to not yet meet food safety requirements. Additionally, this study was limited to examining the E. coli content in sugarcane ice and the source of clean water used to clean the equipment. Not all equipment and the hands of handlers were checked for the presence of E. coli.

"Before being consumed by the public, sugarcane juice goes through a series of processes that include sugarcane production, storage, transportation to the market, milling, and mixing with ice until it reaches the hands of consumers. To ensure that the entire chain meets food safety requirements, counseling and supervision are needed from the Regional Government, specifically the Health Service, as stated in the Decree of the Minister of Health of the Republic of Indonesia Number 942/MENKES/SK/VII/2003 concerning Guidelines for Hygiene Sanitation Requirements for Snack Food. Counseling activities are conducted by health workers together with community cadres to motivate traders to adopt behaviors that support food safety. Meanwhile, supervision of sugarcane juice drinks is carried out through periodic sanitation inspections and the gradual implementation of HACCP by the local Regency/City Health Service.

This study has limitations, even though it uses qualitative data supplemented by laboratory results. One limitation is that testing for the presence of E. coli bacteria was not conducted on the hands of handlers who were in direct contact with the sugarcane ice. Additionally, the equipment used was not tested, even though it was used continuously. If swabs had been taken from the hands and equipment of the officers who handled the food, the results could have provided more precise information regarding the source of E. coli contamination. The researchers were too focused on the bacterial content of the drink, which led to the oversight of these two variables. There is a potential for information bias because expert informants were unwilling to participate in this study, resulting in less balanced information processed by the researchers. Further research can address the shortcomings of this study.

Conclusion

The sanitation of the water used by the sugarcane ice handlers, the condition of the carts, the cleanliness of the equipment, and the hygiene of the sugarcane ice handlers do not meet the sanitary hygiene requirements for street food. Laboratory results of sugarcane ice showed that of the four samples tested, three were positive for E. coli, with results of 6.9 MPN/100 ml and 1.1 MPN/100 ml. In contrast, all water samples used by the sugarcane ice handlers tested negative for E. coli bacteria. It is recommended that sugarcane ice sellers maintain personal hygiene, ensure the cleanliness of processing equipment, and keep the environment around the selling area clean. For

further research, other researchers can include additional testing variables, such as the equipment and hands of food handlers, for more comprehensive results.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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