

DETECTION OF *Staphylococcus aureus* BACTERIA ON ESCALATOR HANDRAINS IN GORONTALO SHOPPING CENTER

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ABSTRACT

Studies have shown that various types of bacteria can be found on escalator handrails, including *Staphylococcus aureus*. This bacteria can survive and reproduce on the surface of the escalator handrail, especially if environmental conditions allow, such as the right humidity and temperature. The purpose of this study was to determine the detection of bacteria *Staphylococcus aureus* on escalator handrails. The method in this study uses a qualitative approach with a descriptive research type. This study was conducted using the scratch method or sample culture on *Mannitol media. Salt Agar (MSA)* and macroscopic, microscopic and catalase biochemical tests were carried out. The results of the study from 8 samples showed that 5 samples detected *Staphylococcus aureus bacteria* macroscopically showed round, irregular round, yellow, yellowish white and mucoid slimy colonies. Microscopic results showed round, grape-shaped, clustered and purple bacteria which were gram-positive bacteria. In the biochemical test (catalase test) gas bubbles were formed. While 3 samples did not detect *Staphylococcus aureus bacteria* by showing irregular colonies, yellowish white in color, microscopic results of rod-shaped bacteria (*Bacillus*), gram positive, in the Biochemical test (catalase) no air bubbles were formed.

Keywords : *Staphylococcus aureus*, Detection, Escalator handrail

INTRODUCTION

Shopping centers are one of the places with high visitor rates and become the center of interaction between many individuals. In shopping centers, escalators are one of the public facilities that are often used by visitors to move from one floor to another. The escalator handrail, which is the part most frequently touched by visitors, has the potential to become a place for the accumulation of bacteria and other microorganisms, including *Staphylococcus aureus* [19]

Studies have shown that surfaces that are frequently touched by many people, such as escalator handrails, can be reservoirs for a variety of microorganisms, including pathogenic bacteria such as *S. Aureus*.

Staphylococcus aureus is a pathogenic bacteria that is often found on the surface of human skin. This bacteria

has the potential to cause various infections, ranging from skin infections to more serious infections such as pneumonia and bloodstream infections. The presence of *S. aureus* on escalator handrails can increase the risk of infection transmission to visitors to shopping centers, especially if cleanliness and sanitation are not well maintained[31]

Previous studies have shown that *S. aureus* can survive on various surfaces and can easily spread through direct contact, so identifying its presence on escalator handrails is very relevant to evaluate the potential risk of transmission in public facilities[28].

In this study, detection of *Staphylococcus aureus bacteria* was carried out macroscopically, microscopically, and biochemically. In macroscopic examination, bacterial culture was examined on agar media, namely

Manitol salt agar (MSA), *Mannitol Salt Agar* (MSA) is one of the culture media used to check for the presence of *Staphylococcus aureus* and distinguish it from other *Staphylococcus species*. This media contains mannitol salt as a carbon source, as well as sodium salt which inhibits the growth of non-*Staphylococcus aureus* bacteria (Jawetz et al., 2020). For the biochemical test used, the catalase biochemical test was carried out to distinguish *Staphylococcus sp species* with *Streptococcus sp. bacteria* which are also bacteria that can grow on MSA (Janda et al., 2019). And the microscopic test was carried out by gram staining to observe the morphology of *Staphylococcus aureus* cells and determine the purity of bacterial cells. [23].

According to the *World Health Organization* (WHO) in 2019. It was obtained around 8.70% from 55 hospitals in 14 countries in Europe, the Middle East, Southeast Asia, and the Pacific. The prevalence of infections caused by *Staphylococcus aureus* bacteria is widely found in Southeast Asia at 11.80%. While in the Americas and the West Pacific each is 7.70%. In Indonesia, infectious diseases are still a common cause of disease in society. In Indonesia, the average prevalence of infections due to *Staphylococcus aureus* bacteria is around 5.1%. In Gorontalo Province, the highest examination results were in Gorontalo Regency 1.3%, followed by Gorontalo City 1.1%, Bone Bolango 0.9%, North Gorontalo 0.8%, and Pohuwato 0.7% [34]

This study aims to see the detection of *S. aureus* on escalator handrails in one of the shopping centers. By collecting this data, it is expected to provide important information for policy makers in developing effective prevention strategies. In addition, this study also aims to increase public awareness of the importance of maintaining hand hygiene after activities in public places, in order to reduce the risk of pathogenic bacterial infection. Based on the background above, the researcher is

very interested in taking the title, "Detection of *Staphylococcus aureus* bacteria on escalator handles at the Gorontalo shopping center.

RESEARCH METHODS

This study uses a qualitative approach with a descriptive type to detect the presence of *Staphylococcus aureus* bacteria on escalator handrails in Gorontalo shopping centers. This study was conducted between June and July 2024, with sampling locations in shopping centers chosen because the escalators are public facilities that are often used by visitors.

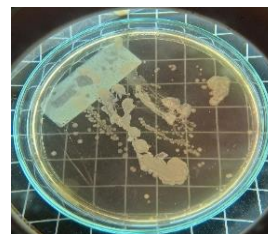
This makes the escalator handrail a potential medium for the spread of bacteria that can be transmitted through hand contact. Laboratory examinations were conducted at the Microbiology Laboratory of Bina Mandiri University, Gorontalo, using direct observation methods, interviews with cleaning staff, and laboratory microbiology analysis to obtain primary data. In addition, secondary data were collected from relevant literature references and historical records .

RESEARCH RESULT

The results of this study are the results of macroscopic microscopic observations and biochemical tests of catalase.

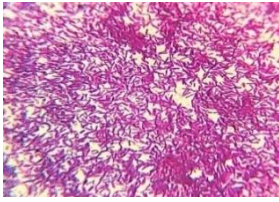
1. PE.1

a. Macroscopic



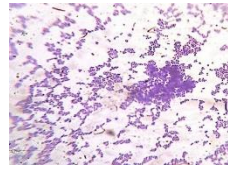
Round Shape
Yellow
Mucoid mucus

b. Microscopic



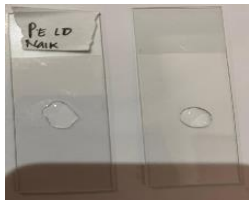
Gram: Positive
Form : Basil

b. Microscopic



Gram Positive
Round Shape (*Coccus*)

c. Catalase Test



Negative (-)

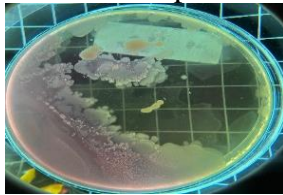
c. Catalase Test



Positive (+)

2. PE.2

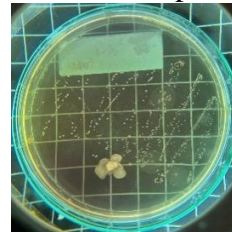
a. Macroscopic



Irregular Shape
,
Yellow
Mucoid Slimy .

4. PE.4

a. Macroscopic



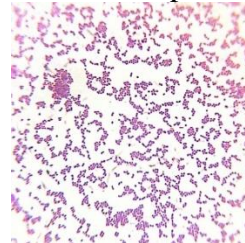
Form round
color yellow
mucoid slimy

b. Microscopic



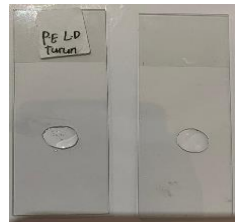
Gram Positive,
Negative
Bacillus Form

b. Microscopic



Gram positive
b form round (*Coccus*)

c. Catalase Test



Negative (-)

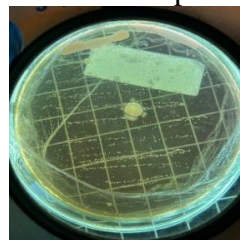
c. Catalase Test



Positive (+)

3. PE.3

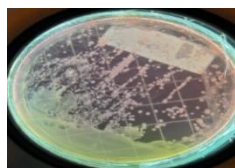
a. Macroscopic



Form round ,
yellow color
mucoid slimy .

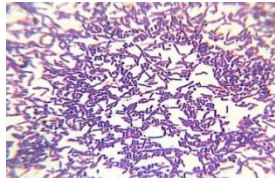
5. PE.5

a. Macroscopic



Round shape
yellow
mucoid mucus

b. Microscopic



Gram Positive
Round Shape (
Coccus)

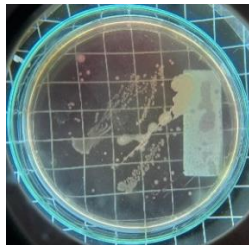
c. Catalase Test



Positive (+)

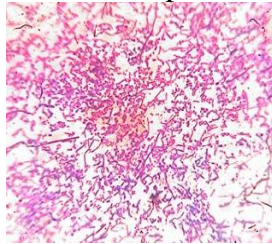
6. PE.6

a. Macroscopic



Round Shape
Yellow Color
Mucoid Slimy

b. Microscopic



Gram: Positive
Shape : Round (
Coccus)

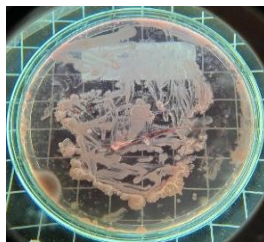
c. Catalase Test



Positive (+)

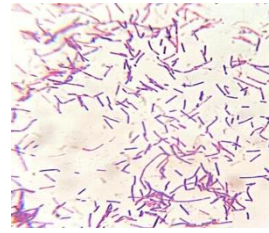
7. PE.7

a. Macroscopic



Irregular Shape
Yellow Color
Mucoid Slimy

b. Microscopic



Gram Positive
Bacillus Form

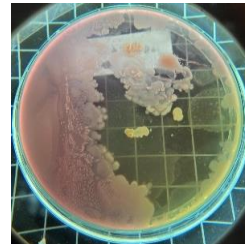
c. Catalase Test



Negative (-)

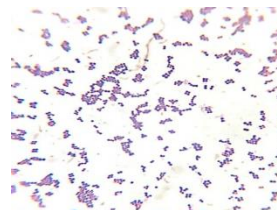
8. PE.

a. Macroscopic



Round Shape
Yellow Color
Mucoid Slimy

b. Microscopic



Gram Positive
Round Shape (
Coccus)

c. Catalase Test



Positive (-)

DISCUSSION

MG shopping center is a place that is often visited by the general public to buy various necessities such as basic necessities, as a means of entertainment, and others. So that it can provide a risk of bacterial contamination in shopping centers that rarely pay attention to environmental cleanliness, for example on the escalator handle which is an object of touch by many people because it is a facility for visitors to go up and down from the lower floor to the upper floor and vice versa so that it can potentially cause various health problems, especially bacteria that can contaminate the escalator handle.

Staphylococcus aureus has the capacity to ferment *mannitol*. This can be detected when *Staphylococcus aureus* is grown in *Mannitol agar*, where it changes color from red to yellow. *Mannitol Salt Agar* is a medium used to identify bacteria from the genus *Staphylococcus*. This medium is selective and differential. This medium contains 7.5% sodium chloride, making it selective because the bacteria cannot grow in a salt concentration of 7.5%, except for bacteria from the genus *Staphylococcus* [10]

According to Aviany and Pujiyanto (2020), macroscopic observations are carried out by examining the general appearance, shape, and color of the colony. To ensure the characteristics of *Staphylococcus aureus* bacteria, further examination is needed, namely microscopic observation is carried out to observe the shape of the bacteria and the bacterial cells themselves. This microscopic observation is to see the Gram properties and cell shape of the bacteria. This staining aims to facilitate the identification of the type of bacteria according to the differences in the structure of their cell walls. Gram-positive bacteria have thick cell walls compared to Gram-negative bacteria.[3]

For *Staphylococcus aureus*. This is reinforced by the results of gram staining
E-ISSN: 2746-167X, Vol. 5, No. 2, Juni. 2024 – pp. 62-70

stating that gram-positive bacteria have a purple color and have a round shape (*Coccus*) which is in an irregular group, resembling grapes.

According to Hayati, et al., (2019) *Staphylococcus aureus* is a round-shaped Gram-positive bacteria (*Coccus*) that shows a purple color when undergoing Gram staining. This purple color is caused by the ability of the bacteria to retain the Crystal Violet color used in Gram staining. The difference in Gram properties is influenced by the composition of the cell wall, where Gram-positive bacteria have a thick peptidoglycan layer compared to Gram-negative bacteria.[10]

in biochemical testing, especially catalase test, is used to reveal the physiological characteristics of isolated bacteria. The biochemical properties of bacteria are related to the metabolic processes in bacterial cells. Bacterial characterization cannot be done only by understanding its morphological characteristics, it is also important to understand its physiological characteristics. Information on the physiological properties of bacteria is very relevant in the characterization process because sometimes the morphology of bacteria can be similar or even unrecognizable. Through biochemical tests, we can identify the properties and determine the species of bacteria, and this test is usually carried out using various types of test reagents [6].

In this study, observations of biochemical tests (catalase tests) using a 3% hydrogen peroxide (H₂O₂) solution were made by adding drops of 3% hydrogen peroxide (H₂O₂) to a clean object glass, then the colony culture suspension was smeared on the object glass that had been dripped with hydrogen peroxide and slowly homogenized using an ose, positive results were indicated by the formation of bubbles.[10]

Staphylococcus has a catalase enzyme capable of hydrolyzing hydrogen peroxide (H₂O₂) into water (H₂O) and producing gas
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bubbles (O₂). If the bacterial suspension is given 3% H₂O₂ and produces gas bubbles, then it shows that the bacteria are *Staphylococcus aureus* . The catalase test is used to differentiate *Staphylococcus* species and *Streptococcus* bacteria , which can grow on *Mannitol media. Salt Agar (MSA)*. (Khairunnisa, 2018).

According to Khairunnisa (2018), catalase testing is carried out to distinguish *Staphylococcus* and *Streptococcus bacteria* , its characteristics show that *Streptococcus* is catalase negative, and *Staphylococcus* is catalase positive. Positive catalase can be recognized through the production of gas bubbles (O₂) by *Staphylococcus* .

Based on the results of the research I conducted using 8 escalator handrail swab samples, the results of the characterization of *Staphylococcus bacteria were obtained. aureus* , PE sample 1 shows the characterization of the agar media irregular colonies, yellow in color, on microscopic examination of rod-shaped bacteria (bacilli) clustered, negative catalase test. In PE sample 2, the agar media colonies are irregular, yellow in color, on microscopic examination of rod-shaped bacteria (bacilli) in elongated chains, purple and red bacteria colors, negative catalase test. In PE sample 3, the agar media colonies are round, yellow in color, on microscopic examination of round bacteria (*coccus*) in the shape of grapes in groups, purple bacteria color, positive catalase test. In PE sample 4, the agar media colonies are round, yellow in color, on microscopic examination of round bacteria (*coccus*) in the shape of grapes in groups, purple bacteria color, positive catalase test. In PE sample 5, the agar media colonies are round, yellow in color, on microscopic examination of round bacteria (positive) in the shape of grapes in groups, purple bacteria color, positive catalase test. In PE 6 sample agar media, the colony is round, yellow in color, on microscopic examination the bacteria are round (*coccus*) in the shape of grapes in groups

of purple bacteria, positive catalase test. In PE 7 sample agar media, the colony shape is irregular, yellow in color, on microscopic examination the bacteria are rod-shaped (bacilli), the color of the bacteria is purple, negative catalase test. In PE 8 sample agar media, the colony is round, yellow in color, on microscopic examination the bacteria are round (*coccus*) in the shape of grapes in groups of purple bacteria, positive catalase test.

It was concluded that of the 8 escalator handrail samples taken, 5 samples showed the characteristics of *Staphylococcus bacteria . aureus* , namely the escalator handrail on the 1st floor goes up and down, the 2nd floor goes up and down, the 3rd floor goes down showing characteristics such as on round colony agar media, yellow in color, on microscopic examination the bacteria are round (positive) in the form of grapes in groups of purple bacteria, positive catalase test, while 2 samples of the escalator handrail on the ground floor goes up and down, and the 3rd floor goes up do not show the characteristics of *Staphylococcus bacteria. aureus* , 3 samples did not show the characteristics of *Staphylococcus bacteria aureus* this is because there is contamination of other bacteria in the research process, bacteria in negative samples show rod-shaped bacteria (bacilli) gram-positive and also negative with negative catalase test results / no air bubbles appear . The laboratory environment does not fully represent the conditions in the field. Factors such as temperature, humidity and air composition in the laboratory can affect contamination, growth and distribution of bacteria.

From the results of the interviews I conducted with the cleaning *service staff* of the shopping center, they clean the escalator handrails several times a day. Usually, they do routine cleaning every morning before the mall opens, and then do additional cleaning during the day and evening. When cleaning, they use personal protective equipment such as gloves and

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masks, then spray disinfectant cleaner on the surface of the handrail and wipe it with a clean cloth that has been dampened with the cleaner. After that, wipe it with a dry cloth to ensure that there is no cleaner residue left and so that the handrail is not slippery. Cleaning staff use *Maxdif Chlorine Disinfectant products* as an escalator handrail cleaner when cleaning, this disinfectant can reduce contamination of viruses, bacteria and fungi.

It is concluded that on the escalator handle there are many microorganisms such as *Staphylococcus aureus bacteria* because the escalator is one of the public facilities used by every visitor to the shopping center which is the distribution of microorganisms because bacteria can move from one hand to another, and also the cleaning staff uses an escalator cleaning agent, namely Maxdif Chlorine Disinfectant, where this product is only for disinfection which only reduces microorganisms on the escalator handle, not to kill all microorganisms.

From the results of my research, there are several samples that show the characteristics of *Staphylococcus aureus bacteria* which if contaminated with this bacteria and enter the body can cause pneumonia, especially in individuals with weak immune systems. *Staphylococcus aureus* can also cause boils (*furuncles*) or abscesses, which are pockets of pus that form under the skin. This infection usually begins with redness, swelling, and pain. If left untreated, this infection can spread and cause further complications. **Cellulitis:** An infection that causes inflammation and redness of the skin and underlying tissue. Cellulitis can cause fever and pain, and can spread if not treated properly. [30]

Studies have shown that various types of bacteria can be found on escalator handrails, including *Staphylococcus aureus*, *Streptococcus*, and *E. coli*. These bacteria can survive and reproduce on the surface of escalator handrails, especially if environmental conditions are favorable,

such as the right humidity and temperature [4].

CONCLUSION

Based on the results of macroscopic, microscopic and test characteristics examinations Biochemical sample of skewered meatball sauce sold on Jalan Jenderal Sudirman Gorontalo City can be concluded as follows:

Macroscopic characteristic observations show that each isolate shows different detections. Macroscopic observations have various characteristics, both in terms of shape, color and mucoid. Colony. The shape of the colony is round, irregularly round, the color of the colony is yellowish white, yellow and mucoid. and the media changes color from red to yellow.

The results of the biochemical test (catalase test) obtained 5 positive (+) samples which were formed gas bubbles, and 3 negative samples (-) no gas bubbles formed.

Microscopic observation of the isolate showed the presence of Gram-positive bacteria, round in shape (*Coccus*) purple in color, which are bacteria *Staphylococcus aureus*. Gram-positive bacteria have cell walls with greater thickness compared to Gram-negative bacteria.

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