

ORIGINAL ARTICLE

Effect of Temperature on Viability of Normal Flora Bacteria (*Escherichia coli* and *Staphylococcus aureus*)

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ABSTRACT

Introduction: *Staphylococcus aureus* is normal flora that lives in the skin and *Escherichia coli* is lives in large intestine. This bacteria has an ability to cause infection disease if the host is not in a good condition. Therefore, research on viability of normal flora was conducted. The objective of this research was to determine the effect of temperature on viability of normal flora bacteria. **Methods:** The research used pre-experimental design, conducted in 2017 in Balai Laboratorium Kesehatan Pengujian dan Kalibrasi NTB. The sample used in the research is the pure isolate of *Staphylococcus aureus* and *Escherichia coli*. Treatment in this research was the temperature difference and its effect. The samples were treated in temperature 500°C, 600°C, 700°C and 800°C for 15 minutes. **Results:** Showed that the growth of normal flora bacteria still occur in 500°C after treatment. **Conclusion:** It can be concluded that there is effect of temperature on viability.

Keywords: Normal flora, Viability, *Escherichia coli*, *Staphylococcus aureus*

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INTRODUCTION

Humans are constantly in contact with thousands of microorganisms. Their habitat is not only in the environment but also in the human body. Microorganisms that naturally inhabit the human body are called normal flora. Bacteria are one of the microorganisms that live in normal flora in humans. However, at this time, with environmental conditions that are increasingly slum or less conducive due to rapid population growth, bacteria, which used to live in normal flora, will grow rapidly when the immune system from the host is weak, or commonly known as infection. (1).

Bacterial infections are acquired from both community and nosocomial. Infections caused by bacteria that often occur are those caused by *Staphylococcus aureus* and *Escherichia coli* (2).

Staphylococcus aureus is found on the surface of the skin because it is a normal flora that is beneficial to the body. These bacteria can become pathogens

when they are in a novel location (wound) in large numbers and there are predisposing factors such as excessive sweating, low pH changes. and unclean showering. (3).

Staphylococcus aureus is one of the most common cause of bacterial infections in the world, such as minor infections of the skin and infections of the eyes. It is estimated that 50% of adult individuals are carriers of *Staphylococcus aureus*. Meticillin resistant *Staphylococcus aureus* (MRSA) is one of the main causes of nosocomial infections in various hospitals in the world, reaching 50% since the 1980s. (4)

Escherichia coli is a normal flora of the human large intestine that causes many infectious diseases and is the main cause of diarrhea as an indicator of water contamination by feces. *Escherichia coli* is the main cause of diarrhea in people (5).

The disease caused by *Escherichia coli* is spread throughout the world, with a very high prevalence of infection in developing countries with an estimated incidence of more than 100 cases per 100,000 population. In Indonesia, diarrhea is still one of the main public health problems. This is because the morbidity rate is still high and causes many deaths, especially in infants and toddlers, and often causes

extraordinary events (KLB). "Diarrhea is the 13th cause of death with a proportion of 3.5%, meanwhile, based on infectious diseases, diarrhea is the 3rd cause of death after TB and pneumonia" (6 p 3).

In a study conducted by Aini (2015) at a temperature of 40°C, 45°C and 50°C with a time of 10 minutes, 20 minutes and 30 minutes, there was a decrease in the average growth rate of *Staphylococcus aureus* bacteria along with increasing temperature and time. given when compared to controls (12). According to Pelczar and Chan (2005), most bacterial cells will be killed within 5-10 minutes at a temperature of 60°C to 70°C with humid heat (7).

Various physical means or processes are available to control the microorganism population. This control can be done by killing microorganisms, inhibiting their growth and metabolism, or physically removing them. The control methods used are determined by the conditions prevailing in the particular situation. The application of temperature is one of the most efficient and effective ways to sterilize a substance. Most bacterial cells will be killed within 5-10 minutes at a temperature of 60°C to 70°C with humid heat (7). Based on the description above, researchers are interested to conduct this research.

MATERIALS AND METHODS

This research was a pre-experimental study to determine a symptom or effect that arises as a result of certain treatments. The population in this study were normal flora species (*Staphylococcus aureus* and *Escherichia coli*) in the form of pure isolates taken from the Balai Laboratorium Kesehatan Pengujian dan Kalibrasi Provinsi NTB (Health Testing and Calibration Laboratory of Nusa Tenggara Barat).

The samples used in this study were pure isolates of *Staphylococcus aureus* and *Escherichia coli*, which were made to suspension equal to 0.5 Mc Farland, the suspension was made using NB media and then incubated for 1x24 hours. The suspension of normal flora bacteria (*Staphylococcus aureus* and *Escherichia coli*) that has been made was heated at 500°C,

600°C, 700°C and 800°C respectively, for 15 minutes. Then, the suspension of *Staphylococcus aureus* and *Escherichia coli* was planted using the pour plate method. incubated 1x24 hours. The results on the media was viewed (seen the growth of bacterial colonies) then collected and processed the data. The sample size in this study was 24 tests with 4 sample treatments.

RESULTS

General description of study

In this study, colony growth and number of colonies were observed at each temperature, namely at 500°C, 600°C, 700°C and 800°C. The results of the growth of bacterial colonies against temperature can be seen in Table I

Table I : The results of observations on the growth of *Staphylococcus aureus* and *Escherichia coli* bacterial colonies against temperature

Temperature (°C)	<i>Staphylococcus aureus</i>			<i>Escherichia coli</i>		
	Replication			Replication		
	1	2	3	1	2	3
50°C	+	+	+	+	+	+
60°C	-	-	-	-	-	-
70°C	-	-	-	-	-	-
80°C	-	-	-	-	-	-

Notes :

- + : Growing
- : Not Growing

The results of observing the growth of *Staphylococcus aureus* bacteria were obtained at 50°C, the growth of bacterial colonies on NAP media was obtained, while at 60°C, 70°C and 80°C there was no colony growth on NAP media. The results of observing the growth of *Escherichia coli* showed that at a temperature of 50°C, the growth of bacterial colonies was obtained on NAP media. Meanwhile, at temperatures of 60°C, 70°C and 80°C, there was no colony growth on the NAP media. The number of colonies of *Staphylococcus aureus* and *Escherichia coli* against temperature can be seen in Table II.

Table II. The number of colonies at each temperature against the bacteria *Staphylococcus aureus* and *Escherichia coli*

Temperature (°C)	Staphylococcus aureus bacterial colonies			Total colonies	Rata-rata	Escherichia coli bacterial colonies			Total colobies	Mean
	Replication					Replication				
	1	2	3			1	2	3		
50°C	8	6	18	32	11	21	5	16	42	14
60°C	0	0	0	0	0	0	0	0	0	0
70°C	0	0	0	0	0	0	0	0	0	0
80°C	0	0	0	0	0	0	0	0	0	0

From the calculation of the number of colonies, it was found that the *Staphylococcus aureus* bacteria at a temperature of 50°C were 32 colonies and the average was 11, while for *Escherichia coli* at 50°C there were 42 colonies with an average of 14.

DISCUSSION

The results of this research on the effect on the viability of normal flora bacteria showed the results that the growth of colonies were only at 50°C. This study showed that there was a difference in the results where at 50°C the *Staphylococcus aureus* and *Escherichia coli* bacteria could still survive, marked by forming colonies on NAP media. Whereas at 60°C, 70°C, 80°C *Staphylococcus aureus* and *Escherichia coli* could not survive which was indicated by not being found to form colonies on NAP media. This is consistent with the statement of Pelczar and Chan (1998), namely that most bacterial cells will die at a temperature of 60°C to 70°C with humid heat.

Staphylococcus aureus is found on the surface of the skin because it is a normal flora that is beneficial to the body. These bacteria can become pathogens when they are in a novel location (wound) in large numbers and there are predisposing factors such as excessive sweating, low pH changes. and unclean showering. (3).

Escherichia coli is an opportunistic bacteria that is commonly found in the human colon as normal flora. The optimum temperature needed for the growth of *Escherichia coli* is 37° C. In this study, the temperature used for the incubation of tested bacteria (*Escherichia coli*) was 37° C which is the optimum temperature of its growth. Thus, because of the suitability between the treatment and the conditions for bacterial growth, one of the factors that influenced the growth of the tested bacteria was fulfilled. So that the bacterial growth takes place optimally (8)

Each bacteria has an optimal temperature where they can grow rapidly and have a temperature range in which they can grow. Cell division is very sensitive to the effects of damage caused by temperatures higher than the temperature that supports rapid growth rates. (9).

The temperature at which a food is stored has a very large effect on the types of microorganisms that can grow and it's growth rate. Several provisions regarding the effect of temperature on cell growth rate are the growth of microorganisms occurring at temperatures in the range of about 30°C. The growth rate of microorganisms increases slowly with increasing temperature until it reaches the maximum growth rate.

Above the maximum temperature, the growth rate decreases with increasing temperature. (10)

Research conducted by Aini (2015) on the growth of *Staphylococcus aureus* bacteria showed the decreasing of the average growth rate at temperatures of 40°C, 45°C and 50°C in 10, 20 and 30 minutes. Temperature and length of heating time are environmental factors that are very influential in bacterial growth. According to Rahmawati et al (2009), changes in temperature can weaken bacteria or cause bacteria to die.

This result is in accordance with the results of research that has been carried out with previous research, that the higher the temperature given, the viability of the bacteria will decrease or the death of bacteria will be occurred.

CONCLUSION

Based on the research, it can be concluded that the number of *Staphylococcus aureus* colonies at 50 ° C was 32 colonies and 42 colonies of *Escherichia coli* bacteria. There was no growth of bacterial colonies at 60 ° C. There was no growth of bacterial colonies at 70 ° C. There was no growth of bacterial colonies at 80 ° C. There was an effect of temperature on the resistance of normal flora bacteria *Staphylococcus aureus* and *Escherichia coli*.

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