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Bacteriological Analysis of Street Food to Support the Availability of Hygienic Functional Foods in Kendari City

Ratna Umi Nurlila[1], Titi Purnama[2], Jumarddin La Fua[3], Marwah[4], Armayani[5]

[1]Pharmacy, Mandala Waluya University
[2,4]Medical Laboratory Technology, Mandala Waluya University
[3]Tadris Biology, Institut Agama Islam Negri Kendari
[5]Nursing Science, Mandala Waluya University

ABSTRACT

Food contaminated by pathogenic bacteria can cause various diseases such as diarrhea and typhoid. Bacterial growth in food can also result in unwanted physical or chemical changes, making the food unfit for consumption. The purpose of this study was to determine the number and type of bacteria in some snacks around health facilities in Kendari City. This type of research is descriptive research, the samples in this study are types of snacks around health facilities in Kendari City with testing methods in the form of Total Plate Numbers, API Test, and Confirmation test. The results showed that the total plate number contamination of 2 out of 5 food samples amounted to 3x103 - 4x103 colonies/g, namely in samples 2 and 3. These results indicate that the total plate number value in these samples is higher than SNI 7388: 2009 which is < 1x102 colonies/g. The number of colonies in sample 1, namely fried sweet potato, amounted to 0, in sample 2, namely fried banana, amounted to 4x103, in sample 3, namely sweet potato, amounted to 3x103, in sample 4, namely tempeh, amounted to 0 and sample 5, namely bakwan, amounted to 0. The type of bacteria in the results of bacterial identification testing using the API method in sample 2 is *Staphylococcus aureu*s and sample 3 is E.coli.

Keywords: Bacteriological Analysis, Snack Food, ALT, Functional Food, Hygienic

INTRODUCTION

In recent years, food-borne pathogenic microorganisms have become a major concern due to their severe impact on health worldwide. It not only affects health but also impacts the economy to a great extent. According to different surveys, it has been concluded that more than half of human diseases are of animal origin and several chronic diseases are spread by vertebrates to humans. About 500 million people in the world suffer from foodborne diseases by consuming contaminated food every year. To detect bacteria contaminating common foods and their toxin production levels in foods, various methods such as molecular techniques, conventional and serological methods are applied by researchers (Tahir, 2023). Microbes in the environment are both beneficial for health and pathogenic microbes that cause disease whose presence can contaminate food (Zulaika, 2023).

The presence of microbes in food that cause food borne disease) caused by contaminated food. Food infection occurs because the consumption of food contains live bacteria that are able to circulate in the intestines and cause disease (Aulia, 2022). The government through the Food and Drug Monitoring Agency (BPOM) and National Standards (SNI) has required microbiological criteria for most food ingredients and products. Food microbiology criteria vary depending on the type of food. In general, the criteria for analyzing food products are total microbial values or total plate numbers, total mold and yeast, and coliform bacteria (Nurlila, *et al.*, 2019). Certain products also require analysis of the presence of pathogenic bacteria (Atma, 2016). Likewise, the spread of nosocomial infections is caused by the interaction between the three main elements in the hospital, namely the host, agent, and environment so that the principle of prevention is to break the chain of interaction (*Tranmission*) of the three elements (Djasfar, 2023). Good procedures (SOPs) for treatment, action and the use or selection of tools are also ways to prevent nosocomial infections (Zaenal, (2022). There are many factors that play a role in food sanitation including water, food processing places, equipment, and food processors. Food processors play an important role in food sanitation efforts because they have the potential to transmit disease (Rahmayani, 2018).

Microbial contamination of food is the result of direct or indirect contamination with pollutant sources, such as soil, air, water, dust, human and animal digestive and respiratory tracts and even the serving process. Therefore, it is necessary to identify microbial contamination, especially microbes that cause food borne diseases such as Salmonella sp (Amiruddin, 2017). Physical food contaminants are contaminants that can be seen with the naked eye. Its existence is due to being carried by animals or because of humans or food handlers who manage food unhygienically (Amaliyah, 2017). The physical environment can affect the quality of food, namely water which is indispensable in the food processing process from preparation to presentation as a disease-causing factor. In food, the occurrence of pollution can be divided into 2, namely direct pollution, namely the presence of pollution that enters directly, both intentionally and unintentionally, such as the entry of hair into processed food ingredients, food serving places, food processing processes to the process of taking food (Nurlila, *et al.*, 2023), the health facility environment as one of the places that sells a lot of food is expected to have good health standards.

RESEARCH METHODS

The type of research used in this study is descriptive by examining samples of snacks around health facilities in Kendari City, to see the number of bacterial colonies using the Total Plate Count (ALT) method and see the type of bacteria.

RESEARCH RESULTS

The results of bacterial identification on snacks samples in this study are presented in the table below

Table 1. Identification of Bacteria in Snacks Around Health facilities

No	Sample	Result	Bacteria
1.	Fried yam	Negative	-
2.	Fried Banana	Positive	*Staphylococcus aureus*
3.	Sweet Potato	Positive	*E.coli*
4.	Tempeh	Negative	-
5.	Bakwan	Negative	

Based on the table above, which was conducted on 5 food samples in the examination of bacterial identification, the results showed that 2 food samples were positive for bacteria, namely in sample 2, namely *Staphylococcus aureus* and sample 3, namely *E.coli*, which did not meet health requirements and as many as 3 other food samples were negative.

Table 2. Total Plate Numbers in Snacks Around Health Facilities

No	Sample	Unit	Total Plate Numbers on food	Quality standard	Description
1.	Fried yam	CFU/25 gram	0	$<10^2$	Eligible
2.	Fried Banana	CFU/25 gram	$4x10^3$	$<10^2$	Not eligible
3.	Sweet Potato	CFU/25 gram	$3x10^3$	$<10^2$	Not qualified
4.	Tempeh	CFU/25 gram	0	$<10^2$	Eligible
5.	Bakwan	CFU/25 gram	0	$<10^2$	Qualified

Description: Qualified: Total plate count <102 colonies/g Unqualified: Total plate number result < 102 colonies/g

Based on the table above, the total plate number of food samples from the sample is known to have the highest total plate number of 4x103 colonies/g, while the lowest total plate number is 0 colonies/g.

Table 3. Results of biochemical reactions using Fire 20 E

Sample	ONPG	ADH	LDC	ODC	CIT	H2S	URE	TDA	IND	VP	GEL	GLU	MAN	INO	SOR	RHA	SAC	MEL	AMY	ARA	Identifikasi
Fried sweet potato																					
Fried Banana	-	-					+			-		+	+	-	+	+	-	-			*S. aureus*
Sweet Potato	+	-	+	+	-	-	-	-	+	-	-	+	+	-	+	+	-	+	-	+	*E.coli*
Tempeh																					

Bakwan																				

Description: OPNG: Ortho Nitrophenyl-ßD-Galactophyranosidase, ADH :Arginine DiHydrolase, LDC: Lysine DeCarboxylase, ODC: Ornithine DeCarboxylase, CIT: CITrate, H2S: H2S Production, URE: UREase, TDA: Tryptophane DeAminase, IND: INDole production, VP: Voges Proskaeur, GEL: GELatinase, GLU: GLUcose, MAN: MANitol, INO: INOsitol, SOR: SORbitol, RHA: RHAmnose, SAC: SACharose, MEL: MELibiose, AMY: AMYgladin, ARA: ARAbinose

API 20E is a standardized identification system which uses 20 miniature tubes or wells for biochemical tests of microorganisms. Based on the results of research from 5 samples tested with API 20E, it is known that 2 samples showed the results of *Staphylococcus aureus* and *E. coli* bacteria. Of the 5 samples of food snacks tested with API 20E, it is known that 2 samples are *Staphylococcus aureus* and *E. coli* bacteria with the results showing if the positive color and negative color are not the same as the sample color. Table 5 shows the biochemical reactions that determine the species of bacteria that can ferment glucose, produce gas and other biochemical reactions.

Table 6. Total sample types of snacks in health facilities based on standards for microbial presence in food.

Kategori sampel makanan	Jumlah	Keterangan
Baik	3	Memenuhi satndar ($<10^2$)
Tidak baik	2	Tidak memenuhi standar ($<10^2$)
Total	5	

From the results of research that has been carried out, the bacteriological quality of food sold around health facilities is tested by conducting a total plate number test. The total plate number test is carried out to determine the number of bacteria contained in the food samples examined (Widhiastuti, P.W., 2019). Based on the tests that have been carried out, the total plate numbers obtained in 5 food samples are 3x103 - 4x103 colonies/g. This result shows that the total plate number value in this study is higher than SNI 7388: 2009, which is <1x102 colonies/g. After the Total Plate Numbers test was carried out, it was followed by a confirmation test to identify the type of bacteria present in the 5 food snack samples. Before biochemical tests are carried out, selective tests are carried out using BA and Mc Conkay media to distinguish gram positive and negative (Amalia, 2023). The results on Mc Conkay selective media show red colonies, which means that bacteria can ferment lactose (Almasari, U. and Indria, C., 2019). This property is a characteristic of E.coli bacteria that can produce acid from lactose fermentation. Alpha hemolysin is a toxin that is responsible for the formation of hemolysis zones around S. aureus colonies on blood medium, which indicates that the bacteria are gram-positive. Furthermore, gram staining was done and then biochemical tests were carried out using API media.

API 20E is a standardized identification system which uses 20 miniature tubes or wells for biochemical tests of microorganisms (Budiarso, 2021) Based on the results of research from 5 samples tested with API 20E, it is known that 2. samples show the results of *Staphylococcus aureus* and *E. coli* bacteria. Of the 5 samples of food snacks tested with API 20E, it is known that 2 samples are *Staphylococcus aureus* and *E. coli* bacteria with the results showing if the positive color and negative color are not the same as the sample color. Based on the results of research on fried food samples, using

the TPC method, of the 5 samples studied, sample 2 (banana) had 4x103 colonies/g and sample 3 (sweet potato) had 3x103. Based on the regulations set by BPOM RI Number HK 00.06.1.52.4011 in 2009 concerning the Maximum Limit of Microbial and Chemical Contaminants in food which is 1 x 104 CFU / gram (BPOM RI, 2009), the fried banana and sweet potato samples are above the threshold so it is not safe for consumption. *Staphylococcus aureus* and *E.coli* were found in the fried banana and sweet potato samples while no bacteria were found in the other samples. These bacteria are a group of Enterobacteriaceae bacteria that cause pathogens such as urinary tract infections, respiratory tract (*pneumonia*), meningitis and infections of injured skin. This bacterial contamination can be caused by unhygienic food handlers, cooking utensils, dirty working environment and selling places, as well as the location of food vendors on the roadside and adjacent to the garbage disposal area so that it can be suspected to be a source of microbial contamination in the jajajan food. In addition, there are buyers who buy snacks by directly holding the snacks so that it becomes one of the sources of microbial contamination in the fried snacks (Deddy, 2022). Bacterial contamination from food handlers' hands has also been identified as one of the factors contributing to the increase in foodborne illness outbreaks in various parts of the world. Pathogenic bacteria can transfer from human hands to food, forming enterotoxins, which can cause a variety of illnesses including acute gastroenteritis. One of the pathogenic bacteria that is often found in food and beverages and is the main indicator of contamination is *E. coli* bacteria (Deddy, 2022).

In addition to these factors, the process of processing food ingredients by sellers is also a factor in bacterial growth. The optimum growth temperature of bacteria is 37 ° C. This may be due to the immature frying process, the improper food storage process and the hygiene factor of the tools used for frying are risk factors for the growth of Salmonella sp. This is also influenced by environmental factors around the place of sale of fried snacks that are less hygienic (Dewi, 2023). Based on observations, it is known that the environment where selling near the gutter and only ± 1 meter from the roadside, food is sold without a lid and traders do not wash their hands first before preparing food (Meiwa, 2019). Superficial skin infections are the most common infections that occur due to direct contact between external objects contaminated with bacteria and the skin. The majority of these superficial skin infections are caused by *Staphylococcus aureus*, which is a commensal bacterium as well as an opportunistic pathogen that can be found on human skin. Manifestations of superficial skin infections due to *Staphylococcus aureus* include impetigo, ecthyma, folliculitis, furunculosis and carbuncle infections. *Staphylococcus aureus* bacterial infection of the skin causes surface lesions that look like blisters and furunculosis (Andayani, 2020). Skin infections in the area of hair follicles, sweat glands, or sebaceous glands can be localized boils or abscesses, such as pimples and ulcers. Bacteremia that occurs can cause endocarditis, hematogenous acute osteomyelitis, meningitis, and lung infections. *Staphylococcus aureus* is one of the causes of nosocomial infections in hospitals, causing food poisoning, and toxic shock syndrome (Kuswiyanto, 2017).

In addition, air sanitation and storage temperature are also one of the factors that cause microbiological contamination of food in samples 2 and 3. Storage at room temperature increases the number of microbes, especially in foods served in the open, the increase in total microbes can reach twice the original amount, and can be contaminated with pathogenic bacteria such as *Escherichia coli*, *Staphylococcus aureus*, or *Salmonella* sp. and other pathogenic bacteria.

CONCLUSION

Based on the research results, it can be concluded that

1. The number of colonies in sample 1, namely fried sweet potatoes, amounted to 0, in sample 2, namely fried bananas, amounted to 4x103, in sample 3, namely sweet potatoes, amounted to 3x103, in sample 4, namely tempeh, amounted to 0 and sample 5, namely bakwan, amounted to 0.
2. The type of bacteria in the test results in sample 2 is *Staphylococcus aureus* and sample 3 is *E.coli*.

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