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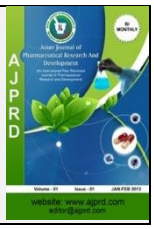

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Research Article

The Utilization of Kepok Banana Fruit (*Musa Paradisiaca*, L.,) As An Alternative Media NA (*Nutrient Agar*) for the Growth Of Bacteria and Mushrooms

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A B S T R A C T

The high cost of instant media such as nutrients encourages researchers to find alternative media from materials that are easily available and cheap. This study aims to determine the growth of bacteria and fungi in alternative media using different carbohydrate sources. The carbohydrate sources used were banana peel and kepok fruit and the results were compared with Nutrient agar (NA) media for bacterial growth and Potato Dextrose Agar (PDA) medium for fungal growth.

This research was conducted experimentally. Kepok banana fruit is processed by cutting it into small pieces then mashed in a blender then filtered and deposited to get the starch, then dried in a drying cupboard at 40°C for 12 hours or until the texture is cracked and dry. The tested bacteria and fungi were inoculated by the scatter method and incubated at 37°C for 24 hours. The parameters observed were the number of bacterial and fungal colony populations. The *mutant Streptococcus*was highest population of in the kepok banana starch medium with a concentration of 5%, *Pseudomonas aeruginosa* the highest population of was in the kepok banana starch medium with a concentration of 5% and *Aspergillus niger* the highest population of was in the kepok banana starch medium with a concentration of 5%.

Based on the results of the research on the number of bacterial and fungal colonies, the best results were on the medium of 5% concentration of kepok banana starch. The results showed that the medium of kepok banana starch can be used as an alternative medium for the growth of bacteria and fungi, the most optimal medium is the medium of starch of kepok banana.

Keywords: Alternative Media, Banana Starch, Microbes

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1. INTRODUCTION

Growth media must meet the nutritional requirements needed by bacteria such as carbon (CO_2 and CH_4), nitrogen (NO_2 and NO_3), as well as the most important mineral elements such as Ca, Zn, Na, K, Cu, Mn, Mg, and Fe, Vitamin , Water, and Gas. The growth media for these bacteria can be in the form of liquid, solid, and semisolid, depending on the bacteria being grown. According to its properties and functions, bacterial growth media are classified into enriched media, exclusive media, selective media, culture media, and media used to study the biochemical properties of a particular bacterium [6].

The best basic food ingredients for bacterial growth are mediums that contain organic substances such as meat stew, leftover vegetables or ingredients made by humans. The medium that is widely used in routine work in the laboratory is liquid broth and broth in order. This medium is composed of 3 g powdered broth, 5 g peptone, and 1000 g distilled water. If a solid medium is needed, 15 g of *Bacto agar* is added [10].

In addition to some examples of plants above, one type of plant that can be used as an alternative medium for bacterial growth and is generally rarely used is the Kepok banana.

Kepok bananas are one of the plants that grow in Indonesia and have good nutritional content. The sugar content in Kepok bananas consists of compounds such as 4.6% dextrose, 3.6% levulose, and 2% sucrose. Kepok banana pulp also contains various vitamins and minerals such as vitamin A, vitamin B1, vitamin C, calcium, phosphorus, and iron [23].The high price of media that reaches millions of rupiah is sold in the market, as well as the abundance of natural resources that can be used as a growth medium for microorganisms encouraging researchers to find alternative media from materials that are easily available and do not require expensive costs. The materials used must contain the nutrients needed for bacterial growth such as ingredients that are rich in carbohydrates and protein [1].

The starch content and several other minerals in Kepok banana are the main energy source for microorganisms, both bacteria and fungi. So that on the basis of this, researchers are interested in conducting research on the development of alternative media for microbial growth. The bacteria used were gram-positive and gram-negative bacteria, namely *Streptococcus mutans* and *Pseudomonas aeruginosa* and *Aspergillus niger.*Based on the above background, the problem formulation at the core of this study is How is the effect of starch concentration of Kepok banana (*Musa paradisiacal* L.) on the growth of bacteria and fungi.The hypothesis of this study is that the concentration of starch in the fruit of Kepok banana (*Musa paradisiaca*,L.,) affects the growth of bacteria and fungi.

2.MATERIAL AND METHODS

This research is an experimental study in which the concentration of starch and starch of Kepok banana (*Musa paradisiaca*,L.)

2.1 Place and Time of

This research was conducted at the Microbiology Laboratory of the Faculty of Pharmacy and Health Sciences, Sari Mutiara Indonesia University, in May-September 2020.

2.2 Microorganisms Test

Strains of gram-positive bacteria *(Streptococcus mutans* ATCC 49456), gram-negative bacteria (*Pseudomonas aeruginosa* ATCC 15442) and fungi (*Aspergillus niger* ATCC 16404).

3.1 Research Procedures

3.1.1 Sample Preparation

Technique for *purposive sampling sampling* is without comparing with other regions or places. Sampling is based on certain considerations that aim to make the data obtained more representative (Sugiyono, 2010). The sample used was Kepok banana (*Musa paradisiaca,*L*)* which was obtained from BSP Housing, Jalan Galang, Tj. Garbus Kp., Kec. Pagar Merbau, Deli Serdang Regency, North Sumatra 20551.

1. Sample

Identification Research sample identification was carried out at Herbarium Medanese, Faculty of Mathematics and Natural Sciences, University of North Sumatra, Medan, Indonesia.

2.Macroscopic Testing of Samples Macroscopic

Examination is carried out by using a magnifying glass or without using tools. This method is used to find the specificity of shape, color, smell, taste, length, width and weight [21].

3.Microscopic Testing of Samples Microscopic

Examination was carried out with the aid of a binocular microscope using aquadest solvent with a magnification of 100 times [21].

3.1.2 Sample Processing

1.Making Starch from Kepok Bananas Kepok

Bananas are chosen with the characteristics of 80-110 days after flowering, with the characteristics of being old but not yet ripe, the skin is still green and the flesh is still a little bit hard (Hardisari and Nur, 2016). Making banana starch is done by washing 4 kg of Kepok bananas clean using running water while brushing it so that the dirt stuck to the skin is gone, then peeling the skin and then cutting it into small pieces (± 1x1 cm). Kepok banana pieces are soaked in water for 5 minutes, then drained and weighed and crushed with a blender to become a pulp by adding 1: 1 (w / v) water. The material is then filtered with a filter cloth to separate the starch and pulp. To the dregs, water is added again with a ratio of 1: 1 (w / v) while kneading to remove the remaining starch, then filtered again. The process of adding water and filtering is carried out twice until the filter results are clear. The filter results are allowed to stand for about 12 hours to settle. After settling, the sediment is dried in a cabinet *dryer at* ± 40^{o}C for ± 12 hours until the starch texture is cracked and then milled and sieved with a 100 mesh sieve to produce kepok banana starch [12].

2.Kepok Banana Fruit Media for Bacterial Growth

The media composition of the Kepok banana can be seen in Table 3.1.

Table 3.1 Media Formula of Kepok Banana.

Formula	Starch Fruit Starch(g)	Peptone (g)	NaCl(g)	Agar(g)	Distilled water (ml)
F1	1	0.5	0.5	1.5	100
F2	2	0.5	0, 5	1.5	100
F3	3	0.5	0.5	1.5	100
F4	4	0.5	0.5	1.5	100
F5	5	0.5	0.5	1.5	100

Description: F = Formula; 1,2,3,4,5 = concentration 1%, 2%, 3%, 4%, 5% w / v

3. Kepok Banana Fruit Media for Mushroom Growth

The media composition of the Kepok banana can be seen in Table 3.3.

Table 3.3 Media Formulas for Banana Fruit Starch in Kepok

Formula	Fruit Starch(g)	Dextrose (g)	Agar(g)	Distilled water (ml)
F1	1	2	1.5	100
F2	2	2	1.5	100
F3	3	2	1.5	100
F4	4	2	1.5	100
F5	5	2	1.5	100

Description: F = Formula; 1,2,3,4,5 = concentration 1%, 2%, 3%, 4%, 5% w / v

4. Examination of pH on the Media

Each starch medium is dropped on the pH indicator, then the color change is observed [22].

3.2 Examination of Characteristics of Skin Starch and Kepok Banana FruitKepok

3.2.1 Macroscopic Examination Macroscopic

Examination was carried out on the shape, smell, and color of the starch of banana [21].

3.2.2 Microscopic examination Microscopic

Examination of kepok banana fruit is carried out by sprinkling starch powder on a slide that has been dripped with distilled water and covered with a cover glass and then observed under a microscope [21].

3.2.3 Determination of Ash Content

Heat a porcelain crucible in a furnace at a temperature of 550°C for approximately one hour and cooled then weighed with an analytical balance. Place 2 g of each starch in a porcelain dish and weigh it. Place the plates containing each of the starches in the furnace at 550°C until a white gray color forms and a fixed weight is obtained. Cooled the plate containing the sample, then weighed [21].

3.2.4 Solubility

Test starch solubility test was carried out at a temperature of 20 to 35°C, the starch sample, namely 5 g, was put into erlemeyer and 100 mL of distilled water was added [25].

3.2.5 Carbohydrate Test Weighing

Each starch 0.05 grams, put into a drop plate, dissolved in distilled water then a drop of 3 drops of lugol solution will form a blue-black precipitate which shows a positive reaction [8].

3.2.6 Protein Test Weighing

Each starch 0.05 grams, put into a drop plate, dissolved with distilled water then dropped 3 drops of NaOH solution then added 3 drops of CuSO4 solution forming a purple color showing a positive reaction [8].

3.3 Testing Method

3.3.1 Preparation of Bacterial and Fungal Culture Stocks

One dose of each pure culture of *Streptococcus mutans*,*Pseudomonas aeruginosa*, and *Aspergillus niger is* inoculated on the surface to slant *Nutrient Agar* and *Potato Dextrose Agar*. Cultures were incubated at 37°C for 18-24 hours [8].

3.3.2 Preparation of Suspension of Bacteria and Fungi.

Colonies were taken from plants NAand PDAusing a loop needle, then suspended in 5 mL of 0.9% NaCl solvent and shaken homogeneously in a test tube [8].

3.3.3Bacteria and Fungi suspension dilution

Dilution Guide suspension of bacteria and fungi 10^{-1} to 5 times, namely, 10^{-2},10^{-3},10^{-4},10^{-5} and 10^{-6} using sterile physiological NaCl where each sterile physiological NaCl is inserted 9 mL into a test tube and 1 mL is added to each dilution sequentially [22].

3.3.4 Preparation of Media on Petri

Dishes Sterile petri dishes are used as containers for media. Media pouring is done in a laminar air flow cabinet. Each petri dish contains 10-15 mL of media. After the media solidifies, the petri dishes are turned over and then covered so that moisture does not drip onto the agar to avoid contamination [22].

3.3.5 Bacterial Inoculation

Each bacterium was tested by several inoculation techniques with the spread method**.** The dilution of the bacterial colony suspension was taken 0.1 mL and put it in a petri dish containing solid agar and flattened using a hockey stick (Dwijoseputro, 1978). After the bacteria wereinoculated with the above method, they were then incubated into a bacterial incubator at 37 ° C for 24 hours, then observed the bacterial growth.

3.4 Data Analysis Techniques

Data collection techniques in this study using experimental methods, literature and documentation. To determine the quality of the growth media for bacteria and fungi, observations were made about the growth of bacteria and fungi on the media used. The observations carried out included the number of bacterial and fungal colonies. Data analysis was carried out in a descriptive qualitative manner with the aim of providing an overview by direct observation including the number of colony growth [1].

RESULT & DISCUSSION

4.1 Sample Preparation Results

4.1.1 The Plant Identification

Identification of kepok banana was carried out at Herbarium Medanese, Faculty of Mathematics and Natural Sciences, University of North Sumatra, Medan. The results

of the identification of Kepok banana (*Musa paradisiaca* L.).

4.1.2 Macroscopic Samples Kepok

Fruit with macroscopic characteristics obtained are slightly curved, slightly flattened and angular, dark green skin mixed with yellow and black spots , the flesh is yellowish white, has normal aroma, slightly chelish taste, size 13 cm long, 5 cm wide, and weighs 110 grams.Bananas generally do not have seeds or parthenocarpy. Banana fruit sizes vary widely, ranging from 10-18 cm in length and 2.5-4.5 cm in diameter. The flesh is thick and soft, the skin of the young fruit is green and when it is old it will turn yellow and have a thick or thin structure depending on the variety. Kepok bananas are slightly flattened and side-shaped. The fruit is small in size, 10-12 cm long and 80-120 g in weight. Seeded or seedless, the seeds are small, round, and black in color. The skin of the fruit is very thick with a greenish yellow color and sometimes has brown stains [20].

4.1.3 Microscopic Samples

The microscopic test results of Kepok banana showed that the starch of Kepok banana was oval. This is in accordance with the opinion of Rudito *et al.* (2010) which states that the starch granules of Kepok banana are oval (oval), and the results of microscopic observations of SNI 01-3841-1995 starch granules of banana flour are oval [7].

4.2 Results of Processing Kepok Banana Fruits

4.2.1 Processing Results of Kepok Banana Fruit Starch

A total of 5 kg of Kepok bananas obtained 985 grams of starch. The yield of the resulting kepok banana starch was 19.7%. This is not much different from the statement of Palupi (2012), the results of the analysis of banana starch yields from various varieties ranged from 13.97 - 23.16%, where horn bananas produced the highest starch yield, namely 23.16%, then followed successively Kepok varieties (19.58%), Ambon (13.97%) and seeds (7.87%).The Banana groups, *plantain* namely horn banana and kepok, have a higher yield, because this type is more starchy and has a larger total dissolved solids [19].

4.2.2 Results of Processing of Kepok Banana Starch

A total of 5 kg of banana peels obtained 35 grams of starch. The yield of the resulting kepok banana peel starch was 0.7%. In the process of processing Kepok banana peel flour which is carried out using the drying method, namely by using sunlight with a temperature of approximately 40^{o}C with a drying time of 2 days (± 12 hours), the yield calculation results are 14.68% with a water content of 7.25% [14].

The results showed that the longer the drying time, the optimal drying process would be because the water content that evaporated would be greater so that the yield produced was less. This is in accordance with the research of Martunis (2012) which states that the difference in high and low yields in a food material is strongly influenced by the water content of a food ingredient.The yield obtained between starch and banana flour is very different, this is because the processes of making starch and flour are also different. In short, flour is made through a process of kneading, drying and milling. Starch is made through the processes of grating, soaking, washing, filtering, settling, drying, and milling. The main key difference lies in washing, sieving and settling, where the manufacture of starch undergoes this process while flour does not. This process causes flour to still contain fiber, fat, protein, and non-starchy carbohydrates, while starch only consists of starch without fat, fiber and protein, as well as non-starchy carbohydrates [18].

4.3 Examination Results of Starch Characteristics

4.3.1 Macroscopic and Microscopic Examination Results of Starch

The results of macroscopic and microscopic examination of kepok banana starch can be seen in table 4.1e

Table 4.1. Macroscopic and Microscopic Examination Results of Starch

No.	Parameters	Yield And Observation of
		Fruit Starch
1.	Macroscopic	Form: fine powder; White color; Odor: normal
2.	Microscopic	There is starch

It can be seen from the table above that the form of fruit starch is obtained, namely fine powder, white color and normal odor and microscopically the form of starch is obtained in the form of starch. According to Palupi (2012), this type of banana produces the brightest starch due to its white flesh. The form of banana starch is fine powder, and smells normal. While banana peel starch has physical characteristics brownish green color, normal aroma and fine powder form and microscopically obtained the form of starch in the form of starch [19].

4.3.2 Ash Content Test Results

The ash content of the material can be determined by oxidizing all organic substances at high temperatures and then weighing the substances left behind after the combustion process. The ash content and composition depend on the type of material (Syabita, 2019).

Ash content generally indicates a higher mineral content in these foods. According to Rudito *et al*., (2010) the ash content of a material is influenced by technical culture factors in the field during cultivation or planting, including the composition and intensity of fertilization, soil type and climate. The result of banana starch ash content obtained

was 1.45%. Based on these data, it is known that the banana starch obtained meets the requirements set for a maximum of 1.5% [7].

4.3.3 Solubility Test Results

This research showed that the solubility results of kepok banana starch were insoluble in warm water. Usually natural starch is insoluble in cold water and most organic solvents include acetone, alcohol and ether. However, it will become water-soluble when the dispersion is heated to a certain critical temperature which is called the gelatinization temperature. Gelatinization is a staple property of starch characterized by changes in physical and chemical properties, characterized by very large swelling, increased viscosity, translucency, solubility.

This change is often caused by breaking the hydrogen bonds in the starch granules which allow water to enter the granules to make them swell as the dispersion is heated. As the temperature increases the viscosity of the dispersion also increases until a stable gel is formed. It is also important to note that as the dispersion temperature increases, stirring will further increase the viscosity of the dispersion. Gelling is characterized by high viscosity and total destabilization of the crystal structure of the granules followed by retrogradation that occurs in gel cooling [22].

4.3.4 Carbohydrate Test Results

Polysaccharides with the addition of iodine will form a specific color adsorption complex. Starch or starch with iodine produces a blackish blue color (Syabita, 2019). The results of the starch carbohydrate test of Kepok banana fruit showed positive results with a blackish blue color change. This is in line with Winarno (2008) who stated that starch that binds to iodine will produce a blue color. According to Herawati (2012) starch is a carbohydrate which is a polymer of glucose, consisting of amylose and amylopectin. Meanwhile, amylose produces a blue color when dripped with iodine solution, while amylopectin produces a reddish brown color [24].

4.3.5 Protein Test Results The protein

Test results obtained in fruit starch are negative because they do not form a purple color, this is because the protein content in Kepok bananas according to Palupi (2012), has the lowest protein content, namely 2.6 g in 100 g material so that it cannot be detected by qualitative testing with NaOH and $CuSO_4$ solvents so that there is no color change. The protein bonding with the biuret produces the basis for the coordination complex reaction between Cu^{2+} and the -C = O and NH peptide groups in alkaline solutions. If the result is positive, it will result in a purple or violet color change [19].

4.4 Results of Making Media from Kepok Banana FruitKepok Banana (*Musa paradisiaca*,L.)

The results of making media for bacterial growth using starch from 5 formulas with 5 concentrations, namely 1%, 2%, 3%, 4% and 5% w/v. This concentration was obtained from changing the original formula, namely the nutrient media formula so that *lemco beef extract* 1 g of and *yeast extract were* 2 g of replaced with fruit starch with a weight of 1 g, 2 g, 3 g, 4 g, and 5 g respectively, while peptone. and NaCl remains 0.5 g and the agar concentration of each formula is the same, namely 1.5 g in 100 mL of distilled water (Anisah, 2015).

Making media for fungal growth using kepok banana starch from 5 formulas with 5 concentrations, namely 1%, 2%, 3%, 4% and 5% w/v. This concentration was obtained from the change in the original formula, namely the PDA (Potato Dextrose Agar) formula where *potato extract was* 4 greplaced with fruit starch with a weight of 1 g, 2 g, 3 g, 4 g, and 5 g respectively, while dextrose remained 2. g and the agar concentration of each formula is also the same, namely 1.5 g in 100 mL of distilled water [15].

4.5 Testing Results of Kepok Banana Media (*Musa paradisiaca* L.)

4.5.1 Results of Testing Media from Kepok Banana Fruit Starch against Bacteria

Alternative media of kepok banana starch can support the growth of bacteria and fungi. This is because kepok banana starch has a high carbohydrate content (Muthmainnah, 2019). The higher the starch concentration of Kepok banana, the higher the growth of bacteria and fungi. In growth media containing carbohydrates, the fungus will excrete the α-amylase enzyme to convert starch into glucose, the glucose compound is then absorbed by the fungus. These nutrients can only be utilized after the fungus has secreted extracellular enzymes that can break down complex compounds from the substrate into simpler compounds [16].

The test results of the kepok banana starch formula against *Streptococcus mutans* and *Pseudomonas aeruginosa bacteria were* carried out using the scatter method which can be seen in table 4.2.

Table 4.2 Results of Testing of Kepok Banana Starch Media against Bacteria

No.	Bacteria	Total Colony CFU / ml					
		NA	F1	F2	F3	F4	F5
			1%	2%	3%	4%	5%
1.	*Streptococcus mutans*x 10^2	∞	139	260	350	∞	∞
2.		∞	137	255	333	∞	∞
3.		∞	100	294	345	∞	∞
4.		∞	142	259	302	∞	∞
5.		∞	105	250	325	∞	∞
	Average	∞	**125**	**264**	**331**	∞	∞
	Standard Deviation	∞	**20.33**	**17.44**	**18.96**	∞	∞

1.	*Pseudomonas aeruginosa*x 10²	∞	308	345	380	∞	∞
2.		∞	287	332	335	∞	∞
3.		∞	302	215	353	∞	∞
4.		∞	294	300	323	∞	∞
5.		∞	279	332	378	∞	∞
	Average	∞	**294**	**305**	**354**	∞	∞
	Standard Deviation	∞	**11.55**	**52, 87**	**25.37**	∞	∞

Information: F = Formula; 1, 2, 3, 4, 5 = concentrations of 1%, 2%, 3%, 4%, 5% w / v; NA = *Nutrient agar*; CFU / ml = Colony Forming Unit (colony unit); 10² = dilutions up to 10²

4.5.2 Results of Testing Media from Kepok Banana Starch to Fungi

The test results of the starch formula of kepok banana against *Aspergillus niger were* carried out by the scatter method can be seen in table 4.4.

Table 4.4 Results of Testing Kepok Banana Fruit Media to Mushrooms

No.	Mushrooms	Number of Colonies CFU / ml					
		PDA	F1	F2	F3	F4	F5
			1%	2%	3%	4%	5%
1.	*Aspergillus niger*x 10²	∞	577	698	807	∞	∞
2.		∞	582	676	881	∞	∞
3.		∞	591	691	835	∞	∞
4.		∞	588	680	850	∞	∞
5.		∞	579	675	864	∞	∞
	Average	∞	**583**	**684**	**847**	∞	∞
	Standard Deviation	∞	**5.94**	**10.07**	**28.27**	∞	∞

Description: F = Formula; 1, 2, 3, 4, 5 = concentrations of 1%, 2%, 3%, 4%, 5% w / v; PDA = *Potato Dextrose Agar*; CFU / ml = Colony Forming Unit (colony unit); 10² = dilution to 10²

The table above shows that the average number of colonies in each formula has increased. At F5 (5%) w/v, microbial growth was better than F1 (1%), F2 (2%), F3 (3%) and F4 (4%) w / v, this is because the concentration of F5 contains the most nutrients. Lots. The more nutrients contained, the more bacteria, fungi or colonies will grow. In control nutrient agar and PDA media, the number of colonies cannot be counted. This is because nutrient agar and PDA media are both clinically tested media for bacterial growth, so that the bacterial metabolic process takes place optimally, while in the medium of Kepok banana fruit starch still has more complex nutrients so that its growth is not as optimal as on nutrient agar [1].

DISCUSSION

Planting the bacteria *Streptococcus mutans* and *Pseudomonas aeruginosa* at various concentrations of starch of Kepok banana 1%, 2%, 3%, 4% and 5% w / v by the scatter method were incubated at 37 ° C within 24 hours showing growth marked by the formation colony. The longer the incubation, the more bacterial colonies will be. This is consistent with the statement of Gandjar (2006), that one of the growth parameters is the increase in cell volume, due to the addition of protoplasm and nucleic acid compounds that involve DNA synthesis and mitotic division. The increase in cell volume is irreversible, meaning that it cannot return to its original volume. In general, a colony is used as a criterion for growth because the cell mass comes from one cell. So something that was not visible at first, namely bacterial colonies, after 24 hours it can be seen by increasing the number of colonies that can be counted with a *colony counter*.

The results and observations showed the presence of bacterial and fungal growth in the banana medium for fruit starch with the spread method used. The growth of bacteria and fungi on fruit starch is better than the growth of bacteria and fungi. (Dinastutie *et.al*, 2015). In the treatment using Kepok banana starch, the bacterial colonies formed were easier to observe because the color of the media from the banana fruit was more transparent, such as the nutrient agar medium.The inulin content in 100 grams of kepok banana is 126.5 mg, 12.35% antioxidants, 1.14% crude fiber, 65.94% water, 0.72% ash, 0.1% fat, 1.76% protein and carbohydrates by 31.48%. In addition, bananas are also rich in minerals such as potassium, magnesium, iron, phosphorus, calcium, vitamin B, vitamin B6, vitamin C, and contain serotonin which is active as a neurotransmitter in smooth brain function (Prabawati *et al.*, 2014). In addition, the chemical content in banana peels is not inferior to the fruit. Banana peels are rich in starch (3%), crude protein (6-9%), crude fat (3.8-11%), total dietary fiber (43.2-49.7%), and polyunsaturated fatty acids. (PUFA) mainly linoleic and α-linoleic acids, pectin, essential amino acids (leucine, valine, phenylalanine, and threonine), as well as various micronutrients (K, P, Ca, Mg) [9].

Bacteria *Streptococcus mutans* grow optimally at temperatures around 18-40 ° C with a pH of 5.2-7 (Fatmawati, 2015),bacteria *Pseudomonas aeruginosa* grow optimally at 37-42 ° C with a pH of 7.4-7.6 (Kumar, 2012) while fungus *Aspergillus niger* grows optimally at a temperature of 24-30 ° C at a pH of 4.5-6.5 [17].

In the manufacture of growth media for bacteria and fungi from Kepok banana, the pH of the skin and banana fruit media was 6, so there were not many differences in the

number of bacterial and fungal colonies obtained, so it can be seen that the factors that most influence the growth of *Streptococcus mutans*, *Pseudomonas aeruginosa* and fungi *Aspergillus niger* is a nutritional factor. These nutritional content can cause *Streptococcus mutans* and *Pseudomonas aeruginosa bacteria* and *Aspergillus niger to* grow on Kepok banana media although the amount is smaller in the starch of Kepok banana peels compared to Nutrient agar media. In addition to nutritional factors, these bacteria are in the adaptation phase, when the bacteria are transferred to a new environment, they will undergo an adaptation process including the synthesis of new enzymes that are different from the previous growth media and recovery of toxic metabolites such as acids, alcohols, and alkalis. The adaptation response can be due to nutrient deficiency in banana media, indicated by the small number of bacteria (Syabita, 2019) in the banana peel starch, bacterial growth at F1 to F5.The growth of fungi with the largest number of colonies was found at F5, namely the Kepok banana variety with a concentration of 5gr / 100 ml fruit starch. The availability of the substrate and the many nutritional content of fruit starch are important factors in the lag phase of the fungus, the initial culture will require sufficient nutrients for growth. The substrate needed by mushrooms in general, the required substrates in the form of carbon, nitrogen, sulfur, potassium, magnesium, sodium, calcium, micronutrients (iron, manganese, zinc, cobalt, molybdenum) and vitamins. However, the elements most needed by *Aspergillus niger* for its growth are carbohydrates (Gandjar, 2006).The colonies formed were more difficult to observe when compared to media made from fruit starch and control media. This is because the colonies is quite large and easy to observe. So that the medium of Kepok banana fruit starch is recommended as an alternative medium for bacterial and fungal growth.

CONCLUSION

From the research results of making alternative media for microbial growth from skin starch and kepok banana fruit that have been carried out, the results showed:

Starch concentration affects colony growth, the greater the starch concentration, the greater the number of bacterial and fungal colonies that grow.

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REFERENCES

1. Anisah., Rahayu, T. Alternative Media for Bacterial Growth Using Different Carbohydrate Sources. *Essay*. Muhammadiyah Surakarta university. 2015.
2. Annisa S, Zulmansyah, Koesmayadi D. The Relationship between Tooth Brushing Pattern and the Incidence of Dental Caries in Children aged 7-10 Years. *Journal*. Bandung Islamic University. 2015.
3. Annisa, SE. Identification and test of bacterial resistance in the operating room Dr.M. Djamil Padang. *Essay*. Padang: Andalas University. 2015.
4. Azizah, DN, K. Endang & F. Fahrauk. Determination of Flavonoid Levels using AlCl3 Method in Methanol Extract of Cocoa Fruit Skins (*Theobroma cacao* L.). *Pharmaceutical Scientific Journal*. 2014. 2 (2): 45-49.
5. Brooks GF, Carroll KC, Butel JS, Morse SA, and Mietzner, TA of Jawetz, Melnick, & Adelberg Medical Microbiology. Ed. 25. Jakarta: EGC Medical Book. 2013. Page 219.
6. Cappuccino, JG and Sherman, N.*Microbiology Laboratory Manual*. Edition VIII. Jakarta: EGC. 2013. Pages: 111, 112, 117, 313, 329, 331, and 332.
7. Damat. Characteristics of Flour from Skin, Flesh and Fruit of Kepok Banana. *GAMMA Journal*. 2013. Vol. 8 (2), 6-13.
8. Depkes, RI. *Regulation of the Minister of Health RI No 416 / Menkes / Per / IX / 1990*. Jakarta. 1990.
9. Dinastutie, Rina. The Effectiveness Test ofKepok Banana Skin Extract Antifungal (*Musa acuminata x balbisiana*Raw) Against the Growth of *Candida albicans* In Vitro. *Journal*. Faculty of Medicine, University of Brawijaya. 2015. Vol: 2 (3).
10. Dwidjoseputro. *Basics of Microbiology*. Publisher Dj bridges: Jakarta. 2010.
11. Fatmawati, Dwi Warna Aju. The Relationship between Streptococcus Mutans Biofilms and the Risk of Dental Caries. Stomatognathic- *Journal of Dentistry*. 2015. ISSN 2442-4935.
12. Hetty, Putu, Armayuni., Putu, Timur, I., AAI Sri, Wiadnyani. Characteristics of Kepok Banana Starch (*Musa Paradisiaca* var. Formatipyca) Modified by the Cross Bonding Method Using Sodium Tripolyphosphate (STPP). *Essay*. UdayanaUniversity. 2015.
13. Jawetz, MA. *Medical Microbiology* (25th ed.). (GF Brooks, KC Carroll, JS Butel, SA Morse, TA Mietzner, Editors, AW Nugroho, D. Ramadhani, H. Santasa, N. Yasdelita, & KW Nimala, Penerj.). New York: Mc Graw Hill. 2010. Page 233.
14. Kiptiah, Mariatul., Nina, Hairiyah., Ayu, Nurmalasari. Effect of Kepok Banana (Skin Substitution*Musa paradisiaca* L.)on Fiber

brownish color of the media can cause a change in the color of the bacterial colony so that observations require more accuracy because the colony is difficult to observe [1].

The colonies formed were more difficult to observe when compared to media made from fruit starch and control media. This is because the brownish color of the media can cause a change in the color of the bacterial colony so that observations require more accuracy because the colony is difficult to observe [1].

The growth of bacteria and fungi on fruit starch is better than the growth of bacteria and fungi on the starch of banana peels (Dinastutie *et.al*, 2015). With more nutrients (carbohydrates), the bacterial metabolic process will run optimally so that the cell division process runs well which can cause the number of colonies to increase (Anisah, 2015).Alternative media of kepok banana starch can support the growth of bacteria and fungi. This is because Kepok banana starch has a high carbohydrate content. In growth media containing carbohydrates, the fungus will excrete the α-amylase enzyme to convert starch into glucose, the glucose compound is then absorbed by the fungus. These nutrients can only be utilized after the fungus has secreted extracellular enzymes which can break down complex compounds from the substrate into simpler compounds (Muthmainnah, 2019).Based on the description above, an alternative medium of starch carbohydrates from Kepok banana has the potential to be used as a medium for bacterial growth. The most effective alternative media is the media from fruit starch because the growth of the bacterial population is said to be good and the number of

Content and Cookies Acceptability. *Journal of Agro-Industrial Technology*. 2018. Vol. 4 (2)

15. Mulyawati, NI, Swasono, Muh. Aniar, H., Utomo, Deny. Effect of Varieties and Concentration of Banana Skin Broth as Alternative Growth Media for *Aspergillus Niger*. *Agromix Journal*. 2019. 10 (2): 114-129.
16. Muthmainnah, Wildatun, Aida., Then Srigede, Yunan Jiwintarum. Use of Ambon Banana (*Musa acumintata*) as an Alternative Media for the Growth of Aspergillus niger Mushroom. *Journal of Medical Analyst Bio Sains*. 2019. 6 (2), 93-97.
17. Naomi, Meiske, Mamuaja., Dokri Gumolung. Growth Test of *Aspergillus niger Mold* on Several Media Materials from North Sulawesi. *Fulleren Journal of Chemistry*. 2018. Vol. 3. (2); 44-51
18. Nurani, S. & Yuwono, SS. Utilization of Kimpul Flour (*Xanthosoma sagittifolium*) as Cookies Raw Material (Study of Flour Proposition and Margarine Addition). *Journal of Food and Agroindustry*. 2014. 2 (2), 50-58.
19. Palupi, Hapsari, Titi. Effect of Banana Types and Soaking Materials on Characteristics of Banana Flour (*Musa* Spp). *Journal of Food Technology*. 2012. Vol. 1 (4).
20. Prabawati, S., Suyanti., And DA Setyabudi. *Postharvest Technology and Banana Management Techniques*. Agricultural Research and Development Agency. Department. Agriculture, Bogor. 2014.
21. SNI. *Tapioca flour*. Jakata: BSN. 2011.
22. Syabita, Yulianda. Manufacture Bacterial Growth Media Using Orange Sweet Potatoes (Ipomoea Batatas (L.) Lam) Against *Streptococcus mutans*, *Streptococcus sanguinus*, and *Stapilococcus aureus*. *Essay*. USU (University of North Sumatra). 2019.
23. Yunan, Jiwintarum et al. The use of Ambon banana (*Musa acuminata*) as an alternative medium for the growth of the Niger Aspergillus fungus. *Journal of Bio Science Analysts*. 2019. ISSN: 2656-2456.
24. Zulaidah, A. Increasing the Use Value of Natural Starch through Starch Modification Process. *Journal of Chemical Engineering*. 2011. 3 (1): 39-45.
25. Zamostny, P., Petru, J., dan Majerova, D.Effect of Maize Starch Excipient Properties on Drug Release Rate. Proceeding on 20th International Congress of Chemical and Process Engineering. Prague, Czech Republic. Czech Republic: Institute of Chemical Technology Prague.2012. 25-29.