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The Effect of the Old Heating Rice Cooker to Total Microbial White Rice with Total Number Plates (Total Plate Count)

Ni Nyoman Yuliani, Joseph Tenamao Werang
Department of Pharmaceutical, Health Polytechnic of Health Ministry Kupang

Abstract: *Rice is the staple food rice processed products are usually consumed by the people of Indonesia. Changes of rice into the rice occur because gelatinize the starch granules contained in rice. When the raw starch put into cold water, the starch granules absorb water and swell. However, the amount of water absorbed only around 30% and Swellings were limited. This swelling occurs because the kinetic energy of the water is stronger than the force of attraction between molecules of starch granules, so that water can get into the grains of starch. Water absorption and swelling of the starch granules can be improved by raising the temperature White rice nutritional content per 100 grams (g), among others, energy 540 kJ / 129 kcal, fat 0.28 g, 0.076 g saturated fat, polyunsaturated fat 0.075 g, monounsaturated fatty 0.087 g, cholesterol 0 mg, protein 2.66 g, 27.9 g carbohydrates, 0.4 g fiber, 0.05 g sugars, 365 mg sodium, 35 mg potassium*
Keyword: *rice cooker, Rice, microbial,*

I. Introduction

A. Background

Rice including food easily damaged, so it is a suitable medium for the growth of pathogenic microorganisms that cause the rice is quickly stale and stinking. Most microbes are microbes mesophyll food destroyer, which grow either at room temperature or at room temperature. Mesophilic bacteria can live with the optimum temperature of 20-45 ^{0} C. Microbial food and pathogen destroyer mesophyll commonly found in food is bacteria *Bacillus cereus* spore-forming, gram-positive bacteria *Staphylococcus aurous,* gram-negative bacteria *Salmonella* and *Escherichia coli.* These bacteria can adapt to live and grow at the optimum temperature around the temperature of its host. The optimum temperature bacteria pathoge n is generally about 37 ^{0} C and the temperature of the incubator to incubate the bacteria cultures is organized around 37 ^{0} C (Radji, 2011).

The era of emerging technology, many housewives who utilize electronic tools such as the *"rice cooker"* for cooking rice and storage so that the rice still warm and durable over a longer period of time. *Rice cooker* are part vaporization *(steam outlet)* that emit steams heat of the rice so often we find rice in the dry state, while the part that has holes in steam expedite re is often a very moist, because the steam condenses on the inside lid of the *rice cooker.* the points of this water then drips back into rice is being heated so that it becomes watery back. If the situation in the *rice cooker* becomes very humid, spoilage bacteria will nest in this place because water vapor is passed through the steam outlet contains nutrients from the rice that evaporates due to the heat (Supardi and Sukamto, 1999).

Previous research conducted by Sari, et al in 2012 on the Influence of the Old Warming In *Rice cooker* Against the Content of Iron (Fe) and Total Microbe White Rice has increased the number of microbes than the average number of microbes (colonies / gram) when the rice is cooked namely 524 500 on prolonged heating 12 hours to 537,000, then to 640,000 in the 24-hour heating times. So, the longer the heating then the total number of microbes will increase (Sari, et al., 2012).

Processing and rice storage can affect the nutrients in food. There are several factors that affect the storage of food and dairy, are time, temperature, water, and pH, which is also the factors that influence the growth of microorganisms (Supardi and Sukamto, 1999).

B. Formulation of the problem

Does prolonged heating of white rice in a *rice cooker* effect on the number of microbes?

C. Research purposes

1. General purpose

To determine the total microbial white rice after prolonged heating in a *rice cooker.*

2. Special purpose

a. To determine the total microbes on white rice on the heating time 0 hours, 6 hours, 12 hours, 24 hours in a *rice cooker.*
b. To Compare the total of microbes on the white rice in the rice cooker heating time with the ISO 7388 standard in 2009 on cereals and cereal products.

D. **Benefits of research**

1. **for the people**

As a source of information in selecting and eating white good rice

II. Literature Review

A. **General Description Rice**

White rice is the type of food consumed by most people of Indonesia. How to make it diverse, both traditional and modern. Traditionally, white rice made by boiling white rice with water in a saucepan to the water runs out then steam it inside the boiler for ± 30 minutes. While the modern, white rice made by boiling rice with a number of water use electronic means rice cooker *(rice cooker)* or that are now widely used that once heated rice cookers *(magic com).* Changes of rice into the rice occur because gelatinize the starch granules contained in rice. When the raw starch put into cold water, the starch granules absorb water and swell. However, the amount of water absorbed only around 30% and swollen them were limited. This swelling occurs because the kinetic energy of the water is stronger than the force of attraction between molecules of starch granules, so that water can get into the grains of starch. Water absorption and swelling of the starch granules can be improved by raising the temperature *(Shafwati, 2012).*

Table 1. Nutritional content in White Rice 100 per Gram

Nutrient content of white rice	Per 100 grams (g)
Energy	540 kj / 129 kcal
Fat	0,28 g
Saturated fat	0,076 g
Polyunsaturated fats	0,075 g
Monounsaturated fats	0,087 g
Cholesterol 2.66 g protein,	0 mg,
Protein	2,66 g
Carbohydrate	27,9 g
Fiber	0,4 g
Sugar	0,05 g
Sodium	365 mg
Potassium	35 mg

(**Source:** Akhyar, 2009).

Cooked rice that have been completed can be stored in two ways, namely in the basket (both made of plastic or bamboo) and in rice warmers tool. Storing rice in the long term, both in the basket or in the rice warmers tool should not be done because it can cause food poisoning. Poisoning is caused by *Bacillus cereus* which is commonly found in rice. These bacteria derive from rice and can survive during the cooking process as it can form spores. These bacteria can grow at an optimum temperature of 30-40 ^{0} C while the spores are resistant to heat up to temperatures of 100 ^{0} C. When the rice cools slowly, the spores will germinate, grow, and produce toxins that can cause emesis vomiting. Reheat before serving rice will not disable the poison or kill all bacteria cells, so that the rice is unsafe for consumption. The presence of these toxins on the rice can not be identified by naked eye because the rice will be seen, smelled, and tasted like normal rice (Radji, 2011). Poisoning would occur if someone swallows bacteria or form spores, the bacteria reproduce and produce toxins in the gut or a person consumes food that already contains the toxin. Toxins produced by *the* bacteria *Bacillus cereus* can cause diarrhea and vomiting, for food made of rice may be tainted with poison that causes vomiting. Toxins associated with vomiting are resistant to heat and repeated heating (Anonymous, 2013).

In the Long-Term Development era II (PJP II) Indonesia faces multiple nutritional problems are more nutritional problems and malnutrition problems with a variety of risks that accompany the disease. One meal is partially or completely influenced by a person's lifestyle, is a risk factor is very high contribution to the emergence of degenerative diseases. Eat more than they need, and eating is not balanced in the sense that most of the risk factors in the food and the lack of protective factors can cause a state of nutrition, which in turn could bring the risk of health problems.

Effect of nutritional foods that carry a variety of unintended consequences beneficial for humans is influenced by time. In general, the adverse effects will be seen in a long time. Without realizing that one's body is actually a deficiency or excess nutrients. Nutrients that give the effect of a long time unnoticed by the patient is a group of nutritional protein, minerals and vitamins. Patients are aware there is a deficiency or excess nutrients after the onset of various diseases of malnutrition. In contrast to food shortages in the means it was not sufficient, for example, eating is not enough that it still feels hungry or experiencing hunger because they do not eat. Food shortages in the not too distant future be known as a result (Zulaikhah, 2005).

Diseases arising from lack of food as good as the food eaten is not enough nutrition, or eating foods that levels of nutrients is not balanced, so-called disease nutritional *disorders,* nutritional disorders disease first was *scorbut* also called thrush.

Many things are the cause of malnutrition, either directly or indirectly. Direct cause nutritional disorders particularly because the incompatibility of the amount of nutrients they get from food with the integrity of their bodies. A poor diet will lead to easy infection because the immune system decreases. Conversely, infectious diseases lead to an increased need for nutrients, while the appetite is usually decreased in case Disease infection, this can lead to better child nutrition will suffer from malnutrition (Rahmawati, 2012).

B. **Test Total Plate Count *(Total Plate Count)***

1. **understanding**

Quantitative methods are used to determine the number of microbes in a sample, generally known as Total Plate Count (TPC). Test Total Plate Count (TPC) and more precisely TPC aerobic or anaerobic mesophyll mesophyll using solid media with the end result in the form of colonies that can be observed visually in the form of numbers in the colonies (cfu) per ml / g or colonies / 100ml. One does this by way of castings (Anonymous, 2008).

2. Principle

Total Plate Count testing according Microbiological Analysis Methods (MA PPOM 61 / MIK / 06) that the growth of aerobic bacteria colonies after footage mesophyll media agar plates inoculated in a manner castings and incubated at the appropriate temperature. In testing the Total Plate Count used PDF (peptone dilution Fluid) as diluents sample and using PCA (Plate Count Agar) as the solid media. Used also a special reagent Tri Phenyl tetrazalim Chloride 0.5% (TTC) was used for staining the bacteria and facilitate the per count colony.

3. Terms Total Plate Count test

Cup count method is based on the assumption that every living cell that can develop into a colony. So the number of colonies that appeared on plates, an index for the number of organisms that can live contained in the sample and the dilution cup results. The samples were diluted with the diluents media in the cup and then incubated (± 24-46 hours) and the observed number of colonies of each cup. Counting colonies by selecting the cup containing between 30 and 300 colonies. Because the amount microorganism previously unknown in the sample, then to acquire at least one dish containing colonies in the number of eligible dilution should be performed in the cup. Number of organisms that are present in the original sample is determined by multiplying the number of colonies formed by the dilution factor at the plate in question. This method is most commonly used for the calculation of the number of microbes. Base is made of a material dilution series with a multiple of 10 of each dilution was taken 1 cc and made sprinkles in Petridis *(pour plate)* with agar kind of way depends on the kinds of microbes. After incubation count the number of colonies per Petridis can determine the number of bacteria per cc or gram sample, ie by multiplying the number of colonies by the reciprocal dilution, for example for the dilution of 1: 10.000 with 45 colonies of bacteria, each cc or grams of material containing 450,000 bacteria. To help calculate the number of colonies in a *colony counter* can be used Petridis are usually equipped with *electronic registers* (Anonymous, 2006).

4. Advantages and disadvantages of Total Plate Count Method

The advantage of the method or methods of growth in order to test Total Plate Count is able to determine the numbers of microbes are dominant. Another advantage can be seen any other kinds of microbes that are natural examples. The weakness of this method according to Buckle (1987), are:

a. The possibility of a colony from more than one cell microbes, such as microbes in pairs, chains or groups of cells. This possibility will reduce the actual number of microbial cells.
b. The possibility of microbial strains that can not grow because of the use of media in order, temperature, pH, or oxygen content during the incubation period.
c. Colonies of microorganisms, especially some of the examples of food, sometimes spread on the surface of the agar medium, so it covers the calculation of growth and other microbes.
d. Calculations performed on an agar medium microbial population size between 30-300 colonies. If fewer than 30 counting the colonies will produce less conscientious statistically, but when more than 300 colonies will produce the same thing as rivalry between colonies.
e. Calculation of the microbial population can be done after an incubation period that generally takes 24 hours or more (Buckle, 1987).

III. Research Methods

A. **Types of research**

This study used an experimental method with *post test only control design.*

B. **Location and Time Research**

1. **Research sites**

Research conducted at the Laboratory of Microbiology Department of Pharmacy Polytechnic of Health MoH Kupang.

2. **Time of the Research**

This research was conducted during the months of June-July, 2015.

C. **Research variable**

1. **The independent variables**

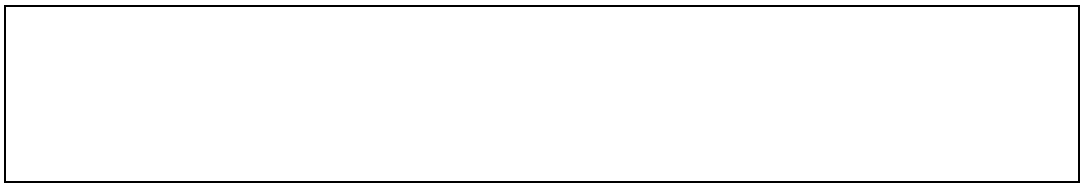
The independent variables in this study are the prolonged heating 0 hours, 6 hours, 12 hours, 24 hours.

2. **Dependent variable**

The dependent variable in this study is total microbes in white rice.

D. **Conceptual framework**

Note :



E. The Subject of Research

The subject in this study was microbial.

F. **Operational definition**

No. variable operational definition

No	Variabel	Defenisi operasional
1	White rice	White rice is cooked using *rice cooker* type cosmos
2	*Rice cooker*	Type cosmos CRJ-525 has a capacity of 1.8 liters, 400 watc cooking, warm 60 watc, weighing 5 kg with a maximum weight of cooked rice and *rice cooker* has been used for three years.
3	old heating	Prolonged heating of white rice with an interval of 0 hours, 6 hours, 12 hours, and 24 hours.
4	total microbial	The number of microbes in a long white rice with heating 0 hours, 6 hours, 12 hours, and 24 hours using the TPC (Total Plate Count)
5	TPC	Quantitative methods are used to determine the number of microbes in a sample by means of casting.

G. **Tools and materials**

1. **Tool**

The Petri dish (Iwaki *Pyrex),* Erlenmeyer (Iwaki *Pyrex),* Incubator, Blender *(Philips),* test tube *(Pyrex),* Pipette volume of 1 mL, 2 mL, 5 mL, and 10 mL *(Pyrex),* Balance analytical *(Precise),* laminar air flow Bunsen burner, Hot plate, Autoclave, Baker glass, Oven

2. **material**

Samples of rice, Plate Count Agar (PCA), Nutrient Broth (NB), Aquadest Alcohol 70%

H. **Work procedures**

1. **Preparation tools and materials**

Before the experiment, all the laboratory equipment used in research has been sterilized and materials ready for use.

a. Sterilization of tools that includes cup like, volume pipette, test tubes, Erlenmeyer, glass beaker done by, inserted into the autoclave and sterilized at 121 ^{0} C for 30 minutes.
b. sterilization media

1. Weighed quantities of materials to be used, be included in the Erlenmeyer.
2. After that the material is diluted with aquadest according to need.
3. Heated over a hot plate so that the solutions quickly dissolve.
4. Media sterilized in an autoclave at a temperature of 121 ^{0} C, for 15 minutes.

2. The procedure of making media

b. *Media Plate Count Agar* (PCA)

1. Weighed 5.6 grams of PCA, the input into the 250-ml Erlenmeyer aquadest
2. Media heated over a hot plate until late
3. Sterilized in an autoclave at a temperature of 121 ^{0} C for 15 minutes
4. Media ready to use

b. *Media Nutrient Broth* (NB)

1. Weighed 2 grams of NB, insert it into the 250-ml Erlenmeyer aquadest
2. Media heated over a hot plate until late
3. Sterilized in an autoclave at a temperature of 121 ^{0} C for 15 minutes
4. Media ready to use

3. Test of Total Plate Count

principle: The growth of mesophyll aerobic bacteria colonies after samples were incubated in medium agar plates by means of a cast and incubated at the appropriate temperature.

Ways of working:

a. By way of aseptic weighed 25 grams of rice by using a blender.
b. 225 mL NB weighed, homogenized in a blender for 30 minutes (dilution 10 $^{-1)}$
c. Prepared 5 or more tubes, each of which has been filled with 9 ml NB.
d. pipette 1 ml of dilution 10 $^{-1}$ into the first NB tube containing 9 mL NB and shaken until homogeneous (dilution 10 $^{-2)}$
e. Created following up on can dilute dilution 10 $^{-9}$
f. From each dilution pipette 1 ml into a sterile petri dish and made duplo
g. PCA 10 mL media inserted into a petri dish, then in rocking slowly so homogeneous.
h. To determine sterility test media and a diluents made control (blank) ie one cup filled 1 ml diluents and media in order, on the other cup filled media order
i. Incubated at 37 ° C for 24 to 48 hours with a reverse pitch position
j. Calculated the number of colonies on a petri dish and select the number of colonies 30-300.
k. calculation colony

1. Been the dish of the dilution that shows the number of colonies between 30-30 0. The average number of colonies of both the cup and multiplied by the dilution factor. Results expressed as Total Plate Count on each gram or per ml of sample.
2. If one of the dish shows the number of colonies is less than 30 or more than 30 0, calculated the average number of colonies, then multiplied by the dilution factor. Results expressed as Total Plate Count on each gram or per m L sample.
3. If there are vials of two successive dilution rate shows the number of colonies between 30-30 0, then count the number of colonies of each level of dilution, then multiplied by the dilution factor. If the calculation results in a higher level gained an average number of colonies greater than twice the average number of colonies dilution below, then ALT selected from lower levels of dilution. If the calculation results in a higher level of dilution are obtained the average number of colonies is less than twice the average amount in dilution underneath the ALT is calculated from the average number of colonies of both the dilution rate.
4. If none of the colonies from the cup then ALT stated as <1 multiply of the lowest dilution factor.
5. If whole cup shows the number of colonies of more than 30 0, have bowls of the highest dilution rate is then divided into several sectors (2, 4 and 8) and counted the number of colonies of one sector. ALT is the number of colonies multiplied by the number of sectors, and then calculated the average of both the cup and multiplied by the dilution factor.
6. The average number of colonies from the chart 1/8 cup more than 200, then declared ALT greater than 200 x 8 multiplied by the dilution factor.
7. Calculation and recording the results of ALT is only written as two numbers. The next Figures rounded down if less than 5 and rounded up if more than 5.
8. If found colonies "spreader" includes a quarter to a half of the cup, then count colonies grown outside the region spreader. If 75% of all bowls have spreader colony with as above, then recorded as "spreader". To this must be sought the factor and improved how it works (the test is repeated).
9. If found colonies spreader chain type 1 series then each separate colonies counted as one colony, and when the spreader group consists of several chains, each chain is counted as one colony (Anonymous, 2006).

I. **Data analysis**

Data analysis is done by comparing the test results with a standard maximum limit of total microbes were still permitted under SNI (Indonesian National Standard).

IV. Results And Discussion

It has conducted research on a sample of cooked rice using a *rice cooker* to identify the total number of microbes on the old heating 0 hours, 6 hours, 12 hours and 24 hours. Sample examination conducted in the laboratory of Microbiology Department of Pharmacy, Ministry of Health polytechnic Kupang. The samples used in this study are in good cook rice in a *rice cooker,* this test will be known how much bacterial contamination in samples of rice with the test method Total Plate Count.

Bacteriological examinations using the two media are solid media and media diluents. On solid medium used for this test is ALT *Plate Count Agar* (PCA). According Fardiaz (1993) stated that in order to examine the total microbial or Total Plate Count may use PCA media as fertilization media for all bacteria, molds, and yeasts can grow well on the medium and for media diluents used PDF.

This research is having some problems namely the unavailability of the diluents media in the form of PDF it is replaced with a suitable diluents medium is *Nutrient Broth* (NB) and the replacement material used has expired. The study also requires reagents *Triphenyl tetrazolam chloride* (TTC), but because the limitations of the materials and the cost of it is not used. The use of reagents TTC has no effect on the results obtained for the TTC used to color bacteria and to facilitate in calculating bacteria to minimize errors in calculations and results are more thorough.

Before doing the research, first conducted orientation that aims to obtain data on the concentration of bacteria that seems to be in the sample with a series of sample dilution. The orientation of the number of germs that can be read on a sample dilution $10^{-4.}$

The test results Total Plate Count (ALT) on white rice in a *rice cooker* is heated for 0 hours, 6 hours, 12 hours, 24 hours can be seen in the table below.

Table 2. Average number of colonies / gram samples

Samples	**Repetition**	**The average number of colonies / gram**
	I	
	II	
when cooked		
	2.83×10^5	
	1.66×10^5	
		$2.24 \times 10^5 \pm 0.827 \times 10^5$
6 hours		
	4.23×10^5	
	2.03×10^5	
		$3.13 \times 10^5 \pm 1.556 \times 10^5$
12 hours		
	6.13×10^5	
	2.56×10^5	
		$4.34 \times 10^5 \pm 2.524 \times 10^5$
24 hours		
	7.76×10^5	
	3.06×10^5	
		$5.41 \times 10^5 \pm 3.323 \times 10^5$

(**Source;** Data Primary Research 2015)

From the data table 2 the average number of colonies / gram sample of the above was found that the longer the heating rice more the number of microbes present in the sample. Heating times with the average number of microbes when cooked (0 hours) of $2.24 \times 10^5 \pm 0.827 \times 10^5$ colonies / gram. Furthermore, an increase in heating times 24 hours with an average total number of microbes of $5.41 \times 10^5 \pm 3.323 \times 10^5$ colonies / gram, and so on. This suggests that prolonged heating of microbes affect the total amount of rice in a *rice cooker.*

Previous research ever undertaken by Sari et al in 2012 on the Old Effect Against *Rice cooker* Warming In The content of Iron (Fe) and Total Microbe White Rice show that prolonged heating at 0 hour / when the total number of microbes 5.24×10^5 colony / gram and the 24-hour total number of microbes $5.37 \times 10^{5.}$ So, the longer the heating then the total number of microbes will increase (Sari, et al., 2012).

The presence of contamination on the rice in a *rice cooker* is probably located on the expenditure vapor *(steam outlet)* that emit vapors heat from the rice so often we find rice in the dry state, while parts that have holes vaporscence become extremely moist, this was due to vapor condensation on the inside lid of the *rice*

cooker. These droplets then drip back into the rice that is being heated so that it becomes watery. If the situation in the *rice cooker* becomes very humid, spoilage bacteria will thrive in this place because water vapor is passed through *the steam outlet* contains nutrients from the rice (Supardi and Sukamto, 1999).

The research result of Total Plate Count (TPC) compared with the Indonesian National Standard (SNI) for the category of cereal with cereal products be eaten directly as wingko and dodol or food products made from rice flour with the limits of microbial contamination of 1 x 10^4 colonies / gram, whereas cereals with cereal product categories as of seeds and rice with the limits of microbial contamination of 1 x 10^6 is not used as a comparison because this product is a product that needs to be processed again so the TPC higher.

This research figures obtained microbes in the heated rice in a *rice cooker* when it is cooked (0 hours) the average number of microbes has exceeded the limits of microbial contamination in ISO 7388 in 2009 on cereals and finished products. The results obtained possibility of contamination of *Bacillus Cereus* belonging mesophilic bacteria are able to change shape into endospores are resistant to heat, so it can survive during the cooking process of rice (Fardiaz, 1993).

V. Conclusions And Suggestions

A. Conclusions

Based on the results of this study concluded:

1. The test results obtained Total Plate Count average number of microbes is when tanak (cooked) (0 hours) of 2.24 x 10^5 ± 0.827 x 10^5 colonies / gram, 6 hours 3, 13 x 10^5 ± 1.556 x 10^5 colonies / gram, 12 hours 4, 34 x 10^5 colonies / gram, and 24 hours of 5, 41 x 10^5 ± 3.323 x 10^5 colonies / gram of rice.
2. The test results obtained Total Plate Count on until l do not meet the requirements in accordance with the Indonesian National Standard (SNI) 7388 2009 on categories of cereals and finished products.

B. Suggestion

1. for the people

Provide information to the public so as not to heat up the rice in a *rice cooker* in a long time. Because the longer the heating time, the average total microbe will increase.

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