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## Ultraviolet Light Application Model in Lowering Germs on Food Snacks at Elementary School in Makassar

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### ABSTRACT

Food is a basic need for human life. Food is very likely to be contaminated, so it can cause a disease called foodborne illness. One alternative for food preservation with ultraviolet light. This study aims to determine the effect of exposure for 30 minutes and 60 minutes with the application of UV light in reducing the number of germs in food snacks in the elementary school environment of Makassar. The type of research is experimental research. Sampling used in the elementary school environment of Makassar. The populations in this study are all sellers in elementary school in Makassar City. The sample in this research is 5 samples of snack food for each observation. Data obtained from examination results is tested with statistical tests which are Wilcoxon method and calculated manually. The data is presented in the form of tables, diagrams, and narration. The results showed by UV light irradiation method on food snack samples for UV exposure for 30 minutes, according to the results of statistical tests with Wilcoxon method of 0.13> 0.05 means that there is no effect of UV lamp used. Exposure to UV light for 60 minutes results 0.04 <0.05 means use of UV lamps gave effect to the number of germ, the best results were obtained at UV exposure for 60 minutes, in addition to the effect of reducing the number of germs visible difference in terms of physical endurance. The conclusion of the study is that there is no influence of UV light exposure model implementation for 30 Minutes in decreasing the number of germs in food or snack, and there is influence of exposure model of UV light application For 60 Minute in decreasing the amount of germ in snack food and snack food have durability with exposure UV rays. Suggestions for future researchers to use longer exposure time comparison. Traders can apply food preservation snacks with UV light models in lowering the number of germs.

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**Keywords:** UV Light, Number of Germ, Preservation, Food Snack

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### INTRODUCTION

In Indonesia the use of food radiation has been determined in the legislation contained in the Minister of Health Decree No. 152 / Menkes / SK / II / 1995 on the Amendment of Attachment of Health Minister Number 826 / Menkes / PER / XII / 1987 on Irradiation Food. Chintya, DR *et al*<sup>1</sup> showed the effect of UV lamp and duration of UV irradiation on physical, chemical, and microbiological properties of mulberry juice with best treatment is mulberry juice of 30 Watt UV lamp and 60 minutes irradiation time and in Suharyono's research, *et al*<sup>2</sup>. The best irradiation, which took 50 seconds, in this process total microbes 1.3 x 10<sup>7</sup> CFU / ml, vitamin C content 24.64 mg / 100g, and lycopene content 0.36. Irradiation with ultraviolet light does not affect the content of vitamin C and lycopene content of tomato juice. Storage for 4 days resulted in decreased vitamin C and lycopene content. 50 seconds of irradiation does not affect the color, flavor and taste of tomatoes, and is acceptable to the consumer.

One alternative food preservation is by irradiation. Irradiation commonly used in food preservation today is with ultraviolet light. This process aims to reduce deterioration due to decay and damage, and to kill microbes. Heating is a conventional processing technology to reduce microbial contamination in foods, especially those that are pathogenic. The process of food processing with heating can cause a less favorable effect on the quality of food products in the form of decreased levels of nutrition and sensory quality. Therefore, the food processing industry continues to develop alternative

preservation technologies to minimize the damage caused by excessive heat<sup>3,4</sup>.

Long radiation is an important factor in UV irradiation. In addition to long irradiation, the rate of inactivation of microorganisms is also a factor affecting UV irradiation. Thus, the non-thermal pasteurization process needs to be developed so that the product does not experience much decrease in nutritional value but the number of microbes remain decreased so that it has a long shelf life, so I as a researcher interested to do this research titled "UV Rays Application Model In Lowering the Number of Germs In Food Snacks In Makassar City Elementary School

### MATERIALS AND RESEARCH METHODS

#### 1. Type of Research

The research type is experimental research that is model of application of UV rays with exposure time 30 minutes and 60 minutes in reducing the amount of germs in food snack in Makassar City and also Control to see the difference specifics.

#### 2. Research Sites

##### a. Location Inspection and sample observation

The location of the examination and observation of samples was carried out at the Laboratory of the Health Department of the Health Polytechnic of Makassar.

##### b. Sampling Locations and Sampling

The collection of samples is done randomly in elementary school environment in Makassar City.

#### 3. Time of research

- a. The preparatory phase, including observations to prepare research proposals and data collection in January - May 2017.
  - b. Implementation phase, including sampling, laboratory examination and data processing and analysis conducted in June - October 2017.
4. Research Variables
- a. The independent variable is the variable that influences the dependent variable ie UV light and food snack.
  - b. The dependent variable is the variable that is influenced by the independent variable that is decreasing the number of germs
  - c. Disturbing variables are the variables that are expected to influence the dependent variable are time, temperature and humidity.

**Objective Criteria:**

- 1) There is an effect of long exposure by using model of application of UV rays for 30 minutes and 60 minutes in lowering the amount of germs in food snacks.
- 2) No effect of long exposure by using model of UV rays There is a long effect of exposure by using model of UV light application for 30 minutes and 60 minutes in reducing the amount of germs in food snacks.
- d. Physical food snacks in this study is the quality of food that includes odor, taste, and texture

**Objective Criteria:**

- 1) Physical food snacks that there is no change in smell, taste, and texture.
  - 2) Physical food snacks that there is a change of smell, taste, and texture.
  - e. Time in this study is the long exposure to food that is preserved by using irradiation technique.
5. Population and Sample
- a. Population The population referred to in this study are all sellers in elementary school in Makassar.
  - b. Sample Sample in this research is 5 sample of snack food that is for snack food each each observation.
7. Data Analysis
- Data obtained from the examination results in statistical tests with Wilcoxon method and done manually and presented in the form of tables, graphs, and narration.

**RESULTS**

Based on the research that has been done and analyzed in the Laboratory of Environmental Health Department, with examination as much as 5 times repetition for the parameters of the number of germs, the results obtained examination as follows:

1. UV Exposure 30 Minutes

**Table 1.** Results of Checking Number of Germs Food Snack Sample with UV Light Exposure 30 Minutes.

| No | Sample  | Result (colony / g) |           |           |           |           |
|----|---------|---------------------|-----------|-----------|-----------|-----------|
|    |         | Beginning           | 30'       | 120'      | 240'      | 360'      |
| 1  | 30'     | 4.156.666           | 1.066.666 | 4.136.666 | 3.403.332 | 2.679.999 |
| 2  | Control | 4.156.666           | 2.033.333 | 3.209.866 | 1.970.000 | 1.399.999 |

Based on table 1 can be seen that the results of examination of the number of germs in food snacks samples for UV exposure for 30 min. obtained an average of the initial sample of 4.156.666 colonies/g, sample observations to 30 min. of 1.066.666 colonies/g,

observation to 120 minutes 4,136,666 colonies / g, sample observation to 240 minutes 3,403,332 colonies / g, and 360 minutes observation samples of 2,679,999 colonies / g.

**Table 2.** Result of statistical tests with wilcoxon method

| Test Statistics <sup>a</sup>  |                                  |                                    |                                    |                                    |
|-------------------------------|----------------------------------|------------------------------------|------------------------------------|------------------------------------|
|                               | UV30 30 Menit - Kontrol 30 Menit | UV30 120 Menit - Kontrol 120 Menit | UV30 240 Menit - Kontrol 240 Menit | UV30 360 Menit - Kontrol 360 Menit |
| Z                             | -1,483 <sup>b</sup>              | -1,214 <sup>c</sup>                | -1,483 <sup>c</sup>                | -1,214 <sup>c</sup>                |
| Asymp. Sig. (2-tailed)        | ,138                             | ,225                               | ,138                               | ,225                               |
| a. Wilcoxon Signed Ranks Test |                                  |                                    |                                    |                                    |
| b. Based on positive ranks.   |                                  |                                    |                                    |                                    |
| c. Based on negative ranks.   |                                  |                                    |                                    |                                    |

From the results of statistical tests with wilcoxon method obtained for UV with time 30 Minutes result 0.13 > 0.05 means there is no effect of UV lamp use. For observation after 120 minutes result 0.22 > 0.05 means there is no effect of UV lamp use. For observation after 240 minutes the result of 0.13 > 0.05 means there is no effect of UV

lamp use. For observation after 360 minutes result 0,22 > 0,05 meaning there is no effect of usage of UV lamp. The results of the average examination of the decrease in the number of germs on the treatment can be seen more clearly on the graph as follows:

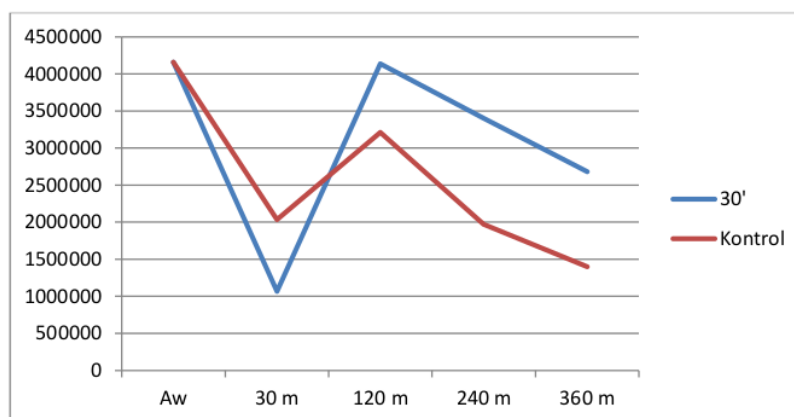


Figure 1. Graph of examination on average decrease amount of exposure 30 minutes

## 2. 60 Minute UV Exposure

Table 3. Results of Checking the Number of Food Sample Germs with 60 Minute UV Light Exposure

| No | Sample  | Result (colony / g) |           |           |           |           |
|----|---------|---------------------|-----------|-----------|-----------|-----------|
|    |         | Beginning           | 60'       | 120'      | 240'      | 360'      |
| 1  | 60'     | 4.156.666           | 1.289.999 | 2.471.999 | 3.413.333 | 3.228.666 |
| 2  | Control | 4.156.666           | 3.863.333 | 3.209.866 | 1.970.000 | 1.399.999 |

Based on table 3 can be seen that the results of examination of the number of germs in food snack samples for UV exposure for 60 minutes obtained an average of the initial sample of 4.156.666 colonies/g, sample observations to 60 min. of 1,289,999 colonies / g,

observation to 120 minutes for 2,471,999 colonies / g, sample observation to 240 minutes for 3,413,333 colonies / g, and 360 min observation samples of 3,228,666 colonies / g.

Table 4. Results of statistical tests with wilcoxon method

| Test Statistics <sup>a</sup>  |                                  |                                    |                                    |                                    |
|-------------------------------|----------------------------------|------------------------------------|------------------------------------|------------------------------------|
|                               | UV60 60 Menit - Kontrol 60 Menit | UV60 120 Menit - Kontrol 120 Menit | UV60 240 Menit - Kontrol 240 Menit | UV60 360 Menit - Kontrol 360 Menit |
| Z                             | -,2023 <sup>b</sup>              | -,944 <sup>b</sup>                 | -,948 <sup>c</sup>                 | -,1214 <sup>c</sup>                |
| Asymp. Sig. (2-tailed)        | ,043                             | ,345                               | ,343                               | ,225                               |
| a. Wilcoxon Signed Ranks Test |                                  |                                    |                                    |                                    |
| b. Based on positive ranks.   |                                  |                                    |                                    |                                    |
| c. Based on negative ranks.   |                                  |                                    |                                    |                                    |

From the results of statistical tests with wilcoxon method obtained for UV with time 60 Minutes result 0,04 < 0,05 meaning there is influence of usage of UV lamp. For observation after 120 minutes result 0,34 > 0,05 meaning there is no effect of usage of UV lamp. For observation after 240 minutes the result of 0,34 > 0,05 means no effect

of UV lamp use. For observation after 360 minutes result 0,22 > 0,05 meaning there is no effect of usage of UV lamp. The results of the average examination of the decrease in the number of germs on the treatment can be seen more clearly on the graph as follows:

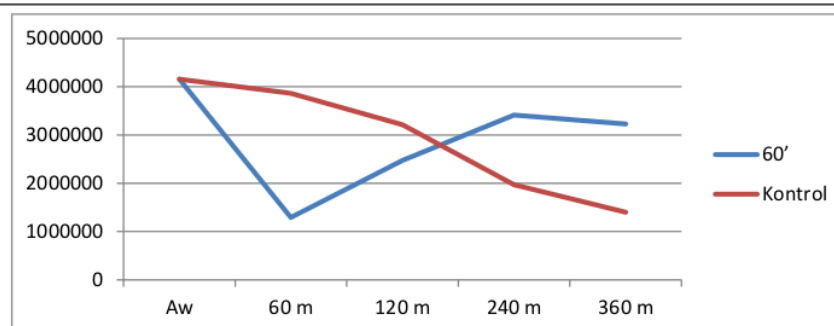


Figure: 2 Graph of examination of the average decrease in the number of germs 60-minute exposure

### 3. Physical Observation UV 30 Minutes

Table 5. Physical Observation Results of Food Samples with UV Exposure 30 Minutes

| No | Samples | Physical Observation Results |          |           |
|----|---------|------------------------------|----------|-----------|
|    |         | Taste                        | Texture  | Smell     |
| 1  | 30'     | good                         | Not good | Not smell |
| 2  | Control | Not good                     | Not good | Not smell |

Based on table 5. it can be seen that the physical observation of food samples with 30 minute UV exposure shows average that is having good taste quality, and

odorless, but its texture is not good, whereas on physical observation result for control generally have taste, and texture is not good but no smell.

### 4. Physical Observation UV 60 Minutes

Table 6. Physical Observation Results of Food Samples with 60 Minute UV Exposure

| No | Samples | Physical Observation Results |          |           |
|----|---------|------------------------------|----------|-----------|
|    |         | Taste                        | Texture  | Smell     |
| 1  | 60'     | Good                         | Good     | Not good  |
| 2  | Control | Not good                     | Not good | Not smell |

Based on table 6 it can be seen that the average result of physical observation of food samples with 60 minute UV exposure that has the quality of taste and texture is still good and odorless, while the average result of control observations generally have a bad taste and texture, but no smell.

## DISCUSSION

### 1. UV Exposure 30 Minutes

Foods consumed should not only meet the nutrients and have an attractive shape, but also safe in the sense that does not contain microorganisms and chemicals that can cause illness and safe for consumption. Safe foods are non-contaminated, containing no microorganisms or bacteria and harmful chemicals.

Irradiation commonly used in food preservation today is with ultraviolet light. This process aims to reduce deterioration due to decay and damage, and to kill microbes. Radiation can inhibit the growth of bacteria, molds, and yeasts<sup>5</sup>.

Based on the results of examination of the number of germs on food snacks samples for UV exposure for 30 minutes obtained an average of 4.156.666 colonies / g, initial sample after 30 minutes exposure experienced a decrease in the number of germs of 1,066,666 colonies / g, sample observation to 120 minutes the number of

germs increased to 4,136,666 colonies / g, sample observation to 240 minutes the number of germs decreased ie 3.403.332 colonies / g, and decrease in germs still occurred in the observation sample to 360 minutes of 2,679,999 colony / g.

Based on the result of statistical test with wilcoxon method obtained for UV after exposure of 30 minutes result  $0.13 > 0.05$  meaning there is no influence of UV lamp use. For observation after 120 minutes result  $0.22 > 0.05$  means there is no effect of UV lamp use. For observation after 240 minutes the result of  $0.13 > 0.05$  means there is no effect of UV lamp use. For observation after 360 minutes result  $0.22 > 0.05$  meaning there is no effect of usage of UV lamp. So when compared between laboratory results with statistical tests used it is appropriate that no effect of 30 minute UV light exposure, which is significant, but there is a decrease in the number of germs

The physical observations on food samples with 30-minute UV exposure showed the average of good taste quality, and odorless, but the texture is not good. This is obtained from UV irradiation for samples I, II and III each having a taste and texture quality that is still good and odorless, in contrast to the IV sample where the taste with good quality on the top surface but the texture on the bottom is not good or watery as well as smelling and



sample V physical qualities with an already bad taste, or watery and smelly. The difference in yield is likely due to the selection of samples or samples used on each experiment varies.

Compared with control samples the average physical observation showed flavor, and the texture was not good but odorless. This is because the control sample is not treated with UV light. So, the use of UV light to see the physical quality of the food has an effect because the observed food samples are still able to survive until the second day. In this study when compared with previous studies have different objectives and different methods but in essence have similarities in terms of function that with UV light irradiation can affect the quality of microorganisms that can reduce the number of germs.

In addition microorganisms can grow on food because it is influenced by several factors one of which ultraviolet light radiation with a certain wavelength and ionization radiation such as X rays and gamma rays can be easily absorbed by the cells of microorganisms. Such rays can disrupt cell metabolism and can generally be rapidly deadly. Based on the theory that ultraviolet rays have the ability to influence the function of living cells by altering the material of the intisel, or DNA, so that the creature dies. This effect is used as a basis for inhibiting the growth of microorganisms in foodstuffs<sup>6</sup>. Therefore exposure to UV light for 30 minutes in general does not give a significant effect on the amount of germs so it is advisable that the duration of exposure added.

#### 2. 60 Minute UV Exposure

Based on the research<sup>11</sup>, the result of examination of the number of germs on food snack samples for UV light exposure for 60 minutes obtained the average of the initial sample of 4,156,666 colonies / g, the observation sample to 60 minutes of 1,289,999 colonies / g, 120 observation samples minutes of 2,471,999 colonies / g, a sample of 240 minutes observation of 3,413,333 colonies / g, and a 360-minute observation sample of 3,228,666 colonies / g.

Based on statistical test results with wilcoxon method obtained for UV with 60 Minutes exposure result 0,04 <0,05 meaning there is influence of usage of UV lamp. For observation after 120 minutes result 0,34 > 0,05 meaning there is no effect of usage of UV lamp. For observation after 240 minutes the result of 0,34 > 0,05 means no effect of UV lamp use. For observation after 360 minutes result 0,22 > 0,05 meaning there is no effect of usage of UV lamp. So it can be concluded that 60 minutes of UV exposure had an effect on the first 60 minutes of observation, but observations after 120 minutes, 240 minutes, and 360 minutes had no effect, but there was a decrease in the number of germs.

Therefore, the duration of exposure has an effect on the decreasing number of bacteria in food samples. As it is known that the decrease in the number of germs is greater when UV exposure is done longer because UV light is known to be one of the rays with radiation power that can be lethal to the organism. UV light has a wavelength of 4 nm to 400 nm with the highest efficiency for microorganism control is 365 nm. UV has a lethal effect on the cells of microorganisms, UV radiation is often used in places that require aseptic conditions such as laboratories, hospital operating rooms, and food and beverage and pharmaceutical production rooms.

On the physical observation with 60-minute UV exposure shows the average of taste and texture quality is still good and odorless. Where food samples with 60 minute UV

exposure showed a better durability effect in comparison with 30-minute UV exposure because samples I, II, III and IV each had good quality flavor and texture and odorless, and the sample V was not good, the texture is not good or watery and smelly. This is because the sample used for the examination has less endurance. In addition, physically the texture of the food is easily damaged

When compared with the result of examination the number of germs on food snack samples for the control obtained average of the initial sample of 4,156,666 colonies / g, on the observation sample to 30 minutes decreased the number of bacteria amounted to 2,033,333 colonies / g, sample observation to 60 min of 3,863,333 colonies / g, observation sample to 120 mins 3,209,866 colonies / g, sample observation to 240 mins 1,970,000 colonies / g, and 360 min observational samples of 1,399,999 colonies / g. so there was a difference between 60 minutes of UV exposure and a control sample not treated with UV light.

Ultraviolet light is an energy that has the ability to penetrate into the cell wall of microorganisms and is able to change its nucleic acid composition. Ultraviolet absorption by DNA (or) RNA The advantage of using ultraviolet light rather than chemical disinfection is very effective in killing most pathogenic bacteria such as E. coli, Giardia, Lamblia, and Cristoporidium, without chemicals, non-toxic, significant non-hazardous, non-hazardous overdose, eliminating some organic contaminants, having no volatile organic compound emissions or toxic air emissions, no odorless and odorless changes in the finished product, enough with less contact time (seconds or minutes) to chemical disinfection, and does not require storage of hazardous materials<sup>7,8</sup>.

The results of previous research conducted by Srigede<sup>9</sup>, is the effect of long-time sterilization of ultraviolet light on the growth of Bacillus sp bacteria, the results obtained that the longer sterilization time decreases the number of bacteria Bacillus. Based on research data showed that there was a decrease in the number of bacteria Bacillus sp in each treatment. After sterilization of 30 minutes 60 minutes, 90 minutes, and 120 minutes using ultraviolet light seen that there is a decrease in the number of bacteria is greatest after sterilization of ultraviolet light for 120 minutes.

When compared to the two previous studies the longer the diminished irradiation of the number of different bacteria with the purpose of this study is to determine the effect of UV light irradiation methods on food snacks but have similarities in terms of influence of UV rays are able to reduce the amount of germs. So the use of UV light irradiation method in this study has an effect although the decrease is not significant is due to less exposure time and suggested to increase the exposure time<sup>10-18</sup>.

#### CONCLUSION

1. There is no effect of UV model for 30 minutes in reducing the number of germs in food snacks.
2. There is influence of UV light implementation model for 60 Minutes in decreasing the number of germs in food snack.
3. Food snacks have long endurance with the presence of UV exposure

**Ethical clearance-** Taken from University ethical committee

**Source of funding-** Self

**Conflict of Interest** – Nil

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