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EFFECTIVENESS OF LIME (*Citrus amblycarpa*) SOLUTION IN IMPROVING THE BACTERIOLOGICAL QUALITY OF TABLEWARE

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ABSTRACT

Effectiveness of Lime (Citrus amblycarpa) Solution in Improving the Bacteriological Quality of Tableware. According to research on cutlery, it did not meet the bacteriological quality requirements for cleanliness because the disinfection process was not carried out. nfection process is necessary to enhance the cleanliness of cutlery, employing both chemical and natural methods. Lime zest is a natural ingredient that can be used for disinfection because it contains compounds such as alkaloids, tannins, steroids, triterpenoids, saponins, and flavonoids that are antibacterial by damaging cell membranes. The study's goal was to determine the efficacy of lime (Citrus amblycarpa) solution in improving the bacteriological quality of cutlery. This research is experimental, with a posttest-only control group design. The study included a total of 24 cutlery (plate) samples. We collected the data by examining the number of germs and Escherichia coli in each sample. Using Kruskal-Wallis, we analysed bacterial count data. Meanwhile, Escherichia coli could not be tested because all the samples were negative. The results showed that the cutlery (plate) before treatment did not contain Escherichia coli. By taking swab samples of the cutlery (plates), we found that the number of germs after disinfection treatment ranged from 1 to 33 colonies/cm2. Lime solution is ineffective at reducing the number of germs. It is recommended that the shop manager use running water and provide a place for draining and storing closed cutlery. Future researchers can conduct laboratory tests first to prove the effect of lime zest on Escherichia coli and carry out control treatments before concentration treatments.

INTRODUCTION

Contaminated food and drinks can be a medium for transmitting food-borne diseases. Food-borne diseases can be influenced by a variety of factors, including food processing habits, unclean storage or serving, and washing and storing equipment. (2). According to Sakinah et al. (2020), the equipment used in preparing food can be a source of contamination (3).

The cleanliness of eating utensils is a crucial and influential part of the quality of food and drinks. Cutting utensils that are not washed cleanly can cause organisms or disease germs to remain behind, grow, and multiply so that they can contaminate the food placed on them.

The Republic of Indonesia Minister of Health Regulation No. 1096 of 2011, which pertains to food service sanitation hygiene on eating utensils, specifies a germ number of 0 (zero). Meanwhile, Minister of Health Regulation Number 14 of 2021, which concerns standards for business activities and products in the implementation of risk-based business licensing in the health sector, states that the requirements for eating equipment contaminated with Escherichia coli must be below 1.1 CFU/cm2. As a result, cutlery must go through various stages of the cutlery washing process to meet health requirements.

The process of washing tableware must go through a disinfection process to improve the quality and cleanliness of tableware, the tableware. The research results of Haderiah et al. (2015) prove that washing tableware at MR and MJ restaurants in Makassar City does not go through a disinfection process. As a result, the bacteriological condition of the tableware does not meet health requirements [4], so a natural disinfection process is needed to prevent the proliferation of bacteria, which can cause contamination of food. Using natural plant disinfection can be an alternative to improving the bacteriological quality of tableware.

The 2017 research by Islamiar et al. on the effectiveness of squeezed kaffir lime leaves on the number of germs on cutlery revealed that kaffir lime leaves contain compounds that act as natural disinfectants. The effective concentration of kaffir lime leaves for reducing germ numbers is 100 mg/100 mL.

Lime kuit is a type of orange typical of the South Kalimantan region that is widely used in cooking as a flavouring and kitchen spice. Limes contain secondary metabolite compounds such as alkaloids, tannins, steroids, triterpenoids, saponins, and flavonoids. [6]. Kuit limes contain compounds with antibacterial properties. It is fascinating to know the effectiveness of the kuit lime (Citrus amblycarpa) solution as a natural disinfectant in improving the bacteriological quality of cutlery.

MATERIALS AND RESEARCH METHODS

Type study [13] This is an experiment. A natural disinfectant called citrus amblycarpa lime solution was used in the study. The concentrations used were 0%, 5%, 10%, 15%, 20%, 25%, 30%, and 35%. The disinfection process involves soaking the plate in a lime solution for two minutes.

The posttest-only control group design was used in the research design [13]. The research was carried out by taking microbial samples from cutlery that was disinfected with a lime solution of varying concentrations with a contact time of 2 minutes, and then comparing them with cutlery that was not disinfected. Each treatment was repeated three times.

The population in this study consisted of all the plates used by typical Banjar food traders at Warung Idris. The samples chosen in this study were plates that had undergone a washing process, taken at random from as many as 24 plates.

The data were entered and analyzed using the Kruskal-Wallis statistical test to determine the difference in germ numbers between the control group and the treatment group with variations in the concentration of lime solution of 5%, 10%, 15%, 20%, 25%, 30%, and 35%. Escherichia coli could not be tested because all samples were negative.

RESEARCH RESULTS AND DISCUSSION

Washing tableware at Warung Idris, consisting of plates, glasses, spoons, and forks, uses river water collected in buckets. The process does not include flushing, which involves soaking cutlery in water before washing with soap and then sanitizing or disinfecting the cleaned cutlery. If the water used to wash equipment is dirty, it must be immediately replaced with new water, because dirty water can contaminate the equipment [16]. Therefore, all eating utensils that come into contact must be kept in a clean condition so that there are no food residues left on the parts of the eating utensils. If this is left unchecked, it will give unwanted bacteria the opportunity to grow and reproduce [17].

Table 1 displays the results of laboratory examinations of bacteriological parameters, specifically the number of germs on wipes of plates that received disinfection treatment using a lime (Citrus amblycarpa) solution with varying concentrations, namely 0%, 5%, 10%, 15%, 20%, 25%, 30%, and 35%.

Table 1: Germ Numbers on Cutlery (Plates)

Repetition (P)	Disinfection Treatment							
	K (Control) (0%)	A (5%)	B (10%)	C (15%)	D (20%)	E (25%)	F (30%)	G (35%)
1	2	33	2	3	7	4	2	18
2	1	2	14	1	4	16	18	2
3	15	15	7	3	4	3	2	3

Source: Research Data for 2023

After disinfecting cutlery (plates) with a lime (Citrus amblycarpa) solution at varying concentrations of 0%, 5%, 10%, 15%, 20%, 25%, 30%, and 35%, the number of germs ranges from 1–33 colonies/cm2. The presence of germs on cutlery can be caused by non-optimal washing of cutlery [14]. The number of germs in each treatment is different because there are other factors that influence the number of germs on cutlery, such as the basic material of the cutlery, the initial condition of the cutlery, washing water, washing tubs, washing power, and scrubbing tools [15]. The equipment washing process does not use running water. Meanwhile, according to Vicky Arnanda (2018), cutlery must be rinsed with clean running water so that the remaining dirt and soap on the cutlery are also removed during rinsing. Cutlery that has gone through all stages of washing is stored in a place free from dust and other dirt [19]. The equipment used to handle and serve food must comply with the requirements for excellent tableware [20].

Poor cleanliness of cutlery can contribute to the growth and spread of bacteria [21], making it necessary to pay attention to cleanliness. This is because microorganisms left on cutlery can grow and contaminate food that comes into direct contact with the cutlery. Therefore, a bacteriological cleanliness test is needed to ensure whether the washing process has been carried out properly and correctly [23].

In the third repetition, the percentage reduction in germ numbers after being given disinfection treatment using lime (Citrus amblycarpa) solution with a contact time of 2 minutes ranged from 53% to 87%. Meanwhile, in the first and second repetitions, there was no significant decrease in the percentage reduction in the number of germ numbers. significant.

It's possible that the number of germs didn't go down after treatment because of things that made disinfection harder, like the fact that the water used for treatment came from a river where the number of bacteria was unknown, the lime solution wasn't extracted, or there are types of microorganisms that aren't killed by disinfectants. This meant that it wasn't impossible for the number of germs to go up. The contents of lime (Citrus amblycarpa) are alkaloids, tannins, steroids, triterpenoids, saponins, and flavonoids [6]. According to Shopia Chairina's research (2022), the flavonoid content in the skin of kuit lime fruit was 0.006%. Kuit lime peel (Citrus amblycarpa) also contains essential oils in 0.472% of wet samples and 0.483% of dry samples [7]. Flavonoids act as antibacterials by damaging cell membranes [11], while essential oils damage cell walls [12]. Saponins can also inhibit and kill microbes by damaging cell membranes [24]. The contents of limes, such as flavonoids, essential oils, and very small saponins, are unable to reduce the number of germs on eating utensils.

Based on the results of the normality test, there are three groups of data that are not normally distributed, so they do not meet the requirements of the One-Way Anova statistical test [25]. The statistical test used was Kruskal-Wallis, and there were no differences between the groups that were disinfected with lime solutions that were 5%, 10%, 15%, 20%, 25%, 30%, and 35% concentrated. The lime (Citrus amblycarpa) solution is ineffective at reducing the number of germs on dinner plates. The Kruskal-Wallis statistical test revealed no distinctions between the treatment groups.

Table 2 shows that Escherichia coli was present on plates before and after disinfection treatment.

Table 2. Escherichia coli on cutlery (plates)

Repetition (P)	Disinfection Treatment							
	K (Control) (0%)	A (5%)	B (10%)	C (15%)	D (20%)	E (25%)	F (30%)	G (35%)
1	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
2	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
3	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)

Source: Research Data for 2023
Information:
(-) : Negative
(+) : Positive

According to Table 2, Escherichia coli on cutlery (plates) was negative before and after disinfection treatment with a lime (Citrus amblycarpa) solution. Kuit limes contain antibacterial properties like flavonoids and essential oils, but this cannot be proven because all samples were negative.

CONCLUSIONS AND RECOMMENDATIONS

The germ numbers on swabs of cutlery (plates) ranged from 1 colony/cm2 to 33 colonies/cm2, while Escherichia coli on swabs of cutlery (plates) was negative, which means there was no Escherichia coli on the cutlery. After the disinfection process, the number of germs fluctuated using varying concentrations of 5%, 10%, 15%, 20%, 25%, 30%, and 35%, indicating an increase or decrease in the number of germs. Lime (Citrus amblycarpa) solution is not effective in reducing the number of germs on eating utensils. Meanwhile, Escherichia coli could not be proven because all samples were negative.

Stall managers are advised to use running water and provide a place for draining and storing closed eating utensils. Researchers can then carry out laboratory tests first to prove the effect of lime on Escherichia coli and carry out control treatment before concentration treatment.

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