



Calculating the Number of Bacterial Colonies of *Escherichia Coli* in the Hands of Food Vendors Around Basic Schools, Sukagumiwang District

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ABSTACK

Diarrhea is still a public health problem in the *Sukagumiwang* sub-district area. Data on diarrhea sufferers in 2018 at the *Sukagumiwang* Community Health Center showed 331 patients of all ages, including 162 toddlers affected by diarrhea. The main factor contributing to diarrhea is poor cleanliness in the preparation of food consumed daily. The aim of this study is to determine the number of *Escherichia coli* bacterial colonies on the hands of food vendors around the elementary schools in the *Sukagumiwang* sub-district area before and after using a hand sanitizer. This study was conducted as an experimental pretest-posttest group design, with sampling performed using simple random sampling. The median number of *Escherichia coli* bacteria present on the hands of food vendors before handwashing in the elementary schools in the *Sukagumiwang* sub-district was 62 CFU/cm². After washing their hands, the median number of *Escherichia coli* bacteria decreased to 8 CFU/cm². The Wilcoxon Signed Rank Test results showed a significant difference, with a p-value < 0.001. There is a significant difference in the number of *Escherichia coli* bacteria before and after using hand sanitizer on food vendors' hands around the elementary schools in the *Sukagumiwang* sub-district area. These findings imply that the intervention using hand sanitizer is effective in reducing bacterial contamination levels.

Keywords: Diarrhea, *Escherichia coli* bacteria.

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INTRODUCTION

Diarrhea cases in Indramayu Regency remain quite high, as indicated by the 2018 Indramayu District Health Office Work Plan (*Renja*) data based on morbidity. In Indramayu Regency in 2017, there were 54,330 cases of diarrhea, representing the highest number recorded in the past five years (Ade Nuraeni et al., 2022; Duvernay et al., 2023; Khaliq et al., 2023; Prawati & Haqi, 2019). From 2017 to October 2017, the under-five mortality rate included 15 deaths due to diarrhea, accounting for 1 case or 6.6%. Data on diarrhea sufferers in 2018 at the *Sukagumiwang* Community Health Center showed a total of 331 patients of all ages, including 162 toddlers affected by diarrhea.

Diarrhea is often caused by infections with pathogenic bacteria such as *Escherichia coli*, which can be easily transmitted through contaminated hands (Bin et al., 2018; Gomes et al., 2016; Makhado et al., 2022; Masiga et al., 2022; Pokharel et al., 2023; Snehaa et al., 2021). Previous studies have highlighted the role of food vendors as potential vectors of foodborne illnesses. For instance, a study by Nasrolahei et al. (2017) in Iran found that 76% of food handlers had contaminated hands, with *E. coli* being one of the most commonly isolated pathogens. Similarly, research by Lambrechts (2014) in South Africa emphasized that improper hand hygiene among food handlers significantly contributes to bacterial contamination. In Indonesia, studies such as those by Fernandez (2017) in Medan and Hasanah (2018) in Sumenep reported that 20% of food vendors tested positive for *E. coli* on their hands. These findings underscore a critical need for improved hand hygiene practices among food handlers, particularly in school environments where children are highly vulnerable.

Poor personal hygiene can be a potential source of infection facilitating the growth of pathogenic bacteria. Food hygiene and sanitation efforts fundamentally include the people handling

food, food processing facilities, food processing equipment, food storage, and food serving. People with poor personal hygiene, especially ineffective hand washing, are important contributors to foodborne illness. The presence of *Escherichia coli* bacteria in food and beverages is an indicator of contamination caused by poor handling of food and beverages (Fauziah & Kemenkes Jambi, 2022; Rahman et al., 2018; SIANA et al., 2022).

The *novelty* of this research lies in its experimental pretest–posttest design, applied specifically to food vendors operating around elementary schools in the *Sukagumiwang* District. While previous studies have largely been descriptive or cross-sectional, this study provides empirical evidence through a controlled intervention—using hand sanitizer—to measure the reduction in bacterial colonies on vendors' hands. This approach not only identifies the problem but also tests a practical solution in a real-world setting.

The lack of knowledge among food vendors in schools regarding how to manage healthy and safe food and beverages increases the risk of contamination of the food and drinks they sell. Hands contaminated with *Escherichia coli* can transmit bacteria to food and cause diseases that may disrupt the teaching and learning process. Based on this description, the researchers aimed to determine the amount of *Escherichia coli* bacteria on the hands of food vendors around elementary schools in the *Sukagumiwang* District area.

The benefits of this research are twofold. Academically, it contributes to the body of knowledge on food safety and public health by providing localized data on bacterial contamination and the efficacy of hand sanitizers in reducing *E. coli* transmission. From a public health perspective, the findings can inform health promotion programs and policies aimed at improving hygiene practices among food vendors, ultimately reducing the incidence of diarrhea and other foodborne diseases among school children. By focusing on a high-risk group within a community setting, this study supports broader efforts to achieve Sustainable Development Goal (SDG) targets related to health, well-being, and clean water and sanitation.

METHOD

The type of this research is an experimental pretest-posttest group design, which aims to investigate conditions observed during laboratory tests by comparing the pretest results before treatment or intervention with the posttest results after intervention on the research subjects, using simple random sampling. The samples in this study were food vendors in the vicinity of elementary schools in the *Sukagumiwang* district who met the inclusion criteria, with a total sample size of 25 people. The comparison of the number of bacteria before and after handwashing was conducted using methods of isolation, identification, and bacterial colony counting with a colony counter, expressed in CFU/cm², carried out in the microbiology laboratory of the UGJ Faculty of Medicine. The sample size in this study was determined using the Slovin formula, with an unknown population size (N), and data analysis was performed using the SPSS program. This research was conducted in February 2020.

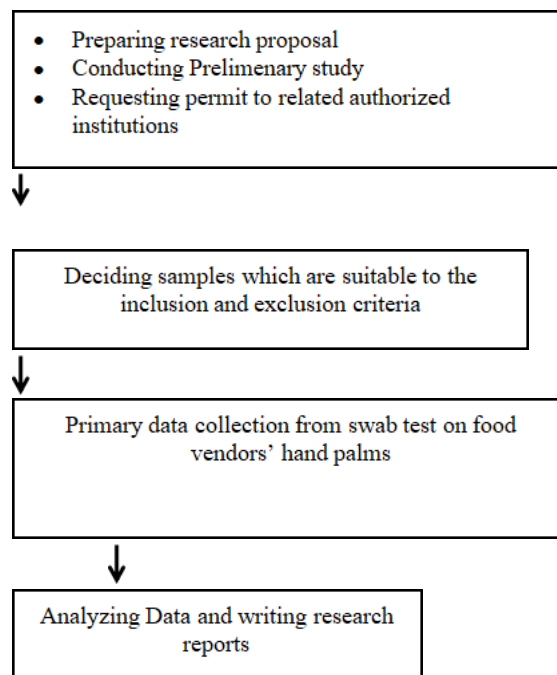
Inclusion Criteria

1. Food vendors who serve food that is in direct contact with their hands.

Exclusion Criteria

1. Food vendors whose hands were contaminated by wounds.
2. Those unwilling to participate in the research (informed consent).

Research Flow



This research has been approved by the Research Ethics Commission of the Faculty of Medicine, Gunung Jati University with an Ethical Clearance of 14/EC/FKUGJ/I/ 2020.

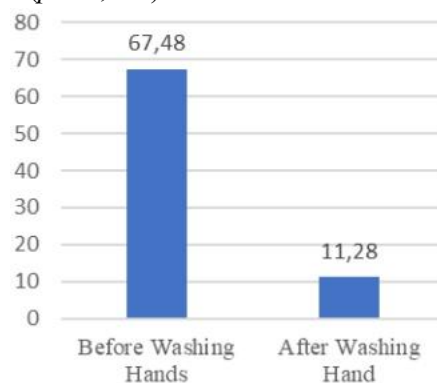
RESULTS AND DISCUSSION

Table 1. *Wilcoxon Test*

Group	Median (Min-Max)	Score <i>p</i>
Before Washing Hands	62 (17-179)	< 0,001
After Washing Hands	8 (2-50)	

Source: Primary Data, Processed by Researchers (2020)

Table 2, shows that there is discrepancy in the number of *Escherichia coli* bacteria on the palm of food vendor around elementary schools at Sukagumiwang District before and after Washing Hands using *hand sanitizer* ($p < 0,001$).



Graphic 1. Median of the number of bacteria colony

Source: Primary Data, Processed by Researchers (2020)

Table 1 dan Graphic 1 shows the descriptive analysis of before and after Washing Hands using hand sanitizer which shows a decrease in bacteria colony after Washing Hands up to 54 CFU/cm

The results of this study showed a decrease in the median number of bacterial colonies before and after washing hands from 62 CFU / cm² to 8 CFU / cm². Thus, it appears that the median number of *E. coli* bacteria colonies after washing hands will be reduced to 54 CFU / cm². This median decrease proved to be statistically significant as evidenced by the *Wilcoxon Signed Rank Test*, the p value was <0.05, which was <0.001. Thus, it can be interpreted that there are differences in the number of *Escherichia coli* bacteria before and after washing hands using a hand sanitizer.

Before the intervention in the form of washing hands by researchers, it was seen that the median number of *E. coli* bacteria colonies on the hands of food vendors was 62 CFU / cm². This result is in line with several previous studies in Indonesia which stated that the hands of food vendors have a significant amount of bacterial contamination. A study conducted by Hasanah Yr. in Sumenep, East Java, in 2018 stated that 20% of food vendors in his research location had positive palms found by *E. Coli*.⁸ Another study in Medan, North Sumatra, conducted by Ian Fernandez in 2017 also shows that 20% of food vendors in the research locations have positive palms found for *E. coli*.² The discovery of *E. coli* bacteria in the palms of the food vendors' hands is most likely caused by low awareness of the importance of hand hygiene, especially for people who work serving food, so the habit of washing their hands is low.

A study conducted by Suryaningtyas N in Yogyakarta in 2019 showed that the knowledge and awareness of food vendors about hand hygiene was only 34.5%. The study also stated that 61.8% of food vendors were not used to washing their hands before preparing their food.⁹ Another study conducted by Wawoh G in 2017 in Tomohon, North Sulawesi, also showed similar results. The study involved 36 food vendors in a market which stated that 27.8% of food vendors had poor knowledge about hand hygiene and were not used to washing their hands.¹⁰ Similar results were also shown by a study conducted by Lilis Angriani in 2018 to food vendors around elementary schools in Kendari City. This cross-sectional study concluded that there are 40% of food vendors in the research location who have poor hand hygiene.

Poor hand hygiene has an impact on the contamination of various bacteria in the food served. This is demonstrated by several studies in various regions in Indonesia, including: (1) research conducted by Kartini S in 2019 at an elementary school in Pekanbaru, Riau, which found coliform, colifecal, and *Salmonella* bacteria in snacks served to students SD12; (2) research conducted by Lamongi in 2017 at an elementary school in Manado, North Sulawesi, which found that 35% of the food sold at the primary school was contaminated with *E. coli* 13; and (3) research conducted by Nuryani in 2016 at an elementary school in Denpasar, Bali, which found that 71% of the food snacks sold at the primary school were contaminated with *E. coli*.

Washing Hands habits are one of the best solutions to reduce *E. coli* contamination in food. This is evidenced by the results of this study which showed that there was a significant decrease in the number of bacteria on the palms of food vendors after intervention in the form of Washing Hands. These results are also in line with a study conducted by Lipinwati in Jambi in 2018. The experimental research with a pretest-posttest control group design involving 90 people conducted by Lipinwati in 2018 concluded that washing hands with soap was effective in reducing the number of bacterial colonies on the hands. The use of hand sanitizers has also been proven effective as shown by a study conducted by Kuenzli E in 2019, a *randomized controlled trial* conducted in several regions in Southeast Asia. The study concluded that the use of hand sanitizers was effective in maintaining hand hygiene and preventing travelers' diarrhea.¹⁵ There was no difference in effectiveness between several types / brands

of hand sanitizers used, as reported by a study at the Christian University of Indonesia that compared three types / brands of hand sanitizers commonly used in Indonesia.

CONCLUSION

The median number of *Escherichia coli* bacteria on the hands of food vendors before washing their hands in SD Sukagumiwang District was 62 CFU/cm². The median number of *Escherichia coli* bacteria on their hands after washing was 8 CFU/cm². There is a significant difference in the number of *Escherichia coli* bacteria before and after washing hands using hand sanitizer on the hands of food vendors around elementary schools in the Sukagumiwang sub-district, with a p-value < 0.05, specifically < 0.001. Based on these findings, it is recommended that a structured and ongoing hygiene training program be implemented for food vendors, emphasizing the correct use of hand sanitizer as part of daily practice. In addition, the local health office and the schools need to collaborate to provide affordable and easily accessible hand sanitizer facilities around the school environment. Further research is also needed to measure the long-term impact of these interventions on hygiene behaviors, as well as the reduction of diarrhea rates in schoolchildren.

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