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BETEL LEAF OIL AS A NATURAL DISINFECTION AGENT IN RADIOLOGICAL EQUIPMENT (STUDY OF MICROBIAL QUANTITY OF RADIOGRAPHIC CASSETTE)

MINYAK DAUN SIRIH SEBAGAI BAHAN DISINFEKSI ALAMI PADA PERALATAN RADIOLOGI (STUDI KUANTITAS MIKROBA KASET RADIOGRAFI)

Research Report
Penelitian

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A B S T R A C T

Background: *Betel leaf oil is a wonderful natural antiseptic. Betel leaf oil is rich in polyphenols, especially chavicol, which can be used to protect against microbe pathogens that cause infection. The cause of the spread of nosocomial infections in radiology can occur using a radiographic cassette. Previous research has found that radiographic cassette contains microorganisms and fungi.* ***Purpose:*** *To determine the effectiveness of using betel leaf oil as a natural disinfection on a radiographic cassette.* ***Method:*** *Quasi-experimental research with pre-test and post-test design designs was carried out by calculating the number of microbes, including Total Plate Count (TPC), Staphylococcus, and fungi. The study on 12 conventional radiographic cassettes was calculated using the swab method before and after cleaning with betel leaf oil. The data were analyzed descriptively to illustrate the rate of decline.* ***Result:*** *The results showed that the percentage rate of decline after the radiographic cassette was cleaned with betel leaf oil was ALT (17.8%), Staphylococcus (57.41%), and fungi (37.21%).* ***Conclusion:*** *Betel leaf oil can be used as alternative natural disinfection on radiographic cassettes, quite effectively suppressing the activity and number of microbes present.*

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A B S T R A K

Latar belakang: Minyak daun sirih adalah antiseptik alami yang luar biasa. Kandungan daun sirih kaya akan polifenol, terutama chavicol dapat digunakan untuk melindungi terhadap patogen mikroba yang menyebabkan infeksi. Penyebab penyebaran infeksi nosokomial dalam radiologi dapat terjadi dalam penggunaan kaset radiografi. Penelitian sebelumnya telah menemukan bahwa radiografi kaset mengandung mikroorganisme dan jamur. **Tujuan:** untuk mengetahui efektivitas penggunaan minyak daun sirih sebagai disinfeksi alami pada kaset radiografi. **Metode:** Penelitian quasi eksperimen dengan rancangan penelitian *pre-test* and *post-test design* dilakukan dengan menghitung jumlah mikroba yang meliputi Angka Lempeng Total (ALT), *Staphylococcus,* dan fungi. Penelitian pada 12 kaset radiografi konvensional yang dihitung menggunakan metode swab sebelum dan sesudah dibersihkan dengan minyak daun sirih. Data dianalisis secara deskriptif untuk menggambarkan tingkat penurunan. **Hasil:** Hasil penelitian menunjukkan bahwa tingkat persentase penurunan setelah kaset radiografi dibersihkan dengan minyak sirih adalah ALT (17,8%), *Staphylococcus* (57,41%), dan fungi (37,21%). **Kesimpulan:** Minyak daun sirih dapat digunakan sebagai alternatif disinfeksi alami pada kaset radiografi cukup efektif dalam menekan aktivitas dan jumlah mikroba yang ada pada kaset radiografi.

Kata kunci:
Minyak daun sirih, MikrobaKaset radiografi

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INTRODUCTION

Diagnostic radiology services are an integral part of medical services that need special attention because, in addition to helping establish a diagnosis, they also have potential dangers for both patients, officers, and the surrounding environment if not held correctly (Aman *et al*., 2022; Nizam *et al*., 2022). To achieve quality and safe radiology services, excellent management and technical management is needed which is supported by good facilities/infrastructure, human resources, and equipment as well. One of the potential dangers in radiological equipment is the presence of nosocomial infection (Darmadi, 2008; Shakoor *et al*., 2019).

Nosocomial infection is a hospital-acquired infection in an incoming patient treated other than for the infection. Still, it does not occur and is not in the incubation period at the time of hospital admission (JY and JK, 2020). Nosocomial infections occur around the world in both developed and developing countries. Nosocomial infections are one of the leading causes of increased morbidity and mortality rates, which can hinder the healing process, resulting in new problems in the health sector, including increased treatment days and increased costs of treatment and treatment of patients in hospitals (Shakoor *et al*., 2019). In the past decades, the risk of infection in health facilities has increased in radiology. This is due to an increase in the number of patients and the modality of radiological examination (Fohely *et al*., 2021; Grasselli *et al*., 2021).

Radiographers may be exposed to infections on the surfaces of radiology equipment and other medical equipment related to radiology. Therefore, it is necessary to carry out regular disinfection activities to prevent the transmission of bacteria, viruses, fungi, and protozoa that cause disease (Cheswick *et al*., 2022). Based on research, Madhumit *et al*. (2019) and Anugrahwati *et al*. (2016) show that betel leaf extract is shown to have strong antimicrobial activity, allowing it to be used by the pharmaceutical and food industries as a natural preservative. This study aimed to learn more about the use of betel leaf oil as a natural disinfection and found, using natural materials based on local wisdom can be improved to control and prevent infections.

MATERIAL AND METHOD

Research design

This research is quasi-experimental with pre-test and post-test design. The selection of this study design aims to determine changes before (pre-test) and after treatment (post-test) in the treatment group (Sugiyono, 2011; Sawilowsky, 2009). The subject of the study was a Radiographic Cassette at the Radiology Laboratory in the Purwokerto Radiology Study Program, Diploma Three Program. This study used a total sampling technique. The sample in this study is total sampling with 12 conventional radiographic cassettes with size variations. Code A is a cassette size 18x24 cm. Code B is a cassette size 24x30 cm. Code C is cassette size 30x40 cm. Laboratory officers of the department of environmental health Poltekkes Kemenkes Semarang carried out colony measurements.

Data collection methods

Data collection begins with taking pre-test data, namely by removing the cassette before being given treatment. Incubation is carried out to calculate the number of microorganisms before treatment. Furthermore, the radiographic cassette was carried out by steaming (swab) with cassa, given piper betel leaf oil with a concentration of 75%, then waited for five minutes (Savsani *et al*., 2020; Anugrahwati *et al*., 2016). After waiting five minutes, the posttest data collection was carried out by applying the cassette after being given treatment. Pre-test and post-test results are carried out through incubation for 2x24 hours in the laboratory. Furthermore, calculating the number of microbes from pre-test and post-test results was carried out. Then the microbial counting data were entered in the data processing table to analyze the change in the number of microbes on the cassette between the pre-test and post-test.

Data analysis methods

The data were processed through manual and computerized editing, coding, entry, and tabulating. Then it is presented as a comparative table of the difference in the number of microbes between the pretest and the posttest (Murugesan *et al*., 2020).

RESULT

Total Plate Count (TPC)

Based on the study's results measuring the number of colonies on the Total Plate Count (TPC) obtained from the pretest and posttest, the results are shown in Table 1. Based on the table above, it can be seen that there is a significant decrease in the number of TPC on radiographic cassettes after being given treatment in the form of betel oil smearing. A comparison graph of the pre-test and post-test on the measurement of the TPC can be seen in Figure 1.

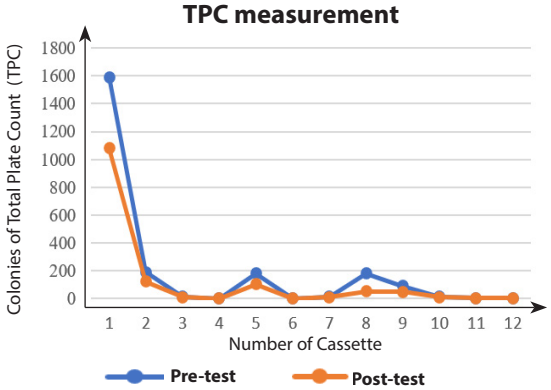

Figure 1. TPC measurement chart

Table 1. Research measurement results colonies of Total Plate Count (TPC)

No	Cassette code	Pre-test (colony)	Post-test (colony)
1	A1	1590	1080
2	A2	190	122
3	A3	13	10
4	A4	2	2
5	B1	180	105
6	B2	1	2
7	B3	13	11
8	B4	180	53
9	C1	90	48
10	C2	15	10
11	C3	4	5
12	C4	5	3

Code A : Cassette size 18x24 cm; Code B : Cassette size 24x30 cm; Code C : Cassette size 30x40 cm

Staphylococcus

Based on the results of the study by measuring the number of *Staphylococcus*, the results are shown in Table 2.

Table 2. Research measurement results of *Staphylococcus*

No	Cassette code	Pre-test (CFU/gram)	Post-test (CFU/gram)
1	A1	33	11
2	A2	9	7
3	A3	1	1
4	A4	1	0
5	B1	1	0
6	B2	2	0
7	B3	1	1
8	B4	2	2
9	C1	5	0
10	C2	2	0
11	C3	1	0
12	C4	1	1

Code A : Cassette size 18x24 cm; Code B : Cassette size 24x30 cm; Code C : Cassette size 30x40 cm

Based on the Table 2, it can be seen that there is a significant decrease in the amount of *Staphylococcus* on radiographic cassettes after being given treatment in the form of betel leaf oil smearing. A comparison graph of the pre-test and post-test on *Staphylococcus* measurements can be seen in Figure 2. The following is a documentation of the implementation of the research shown in the Figure 4.

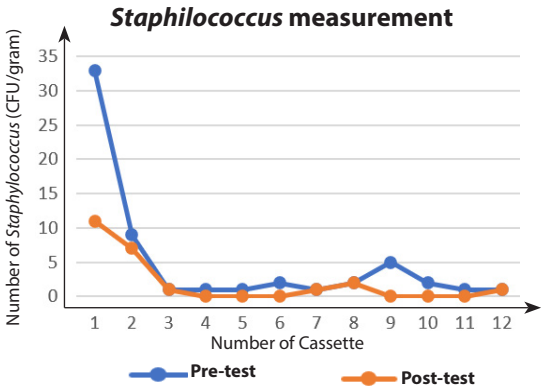

Figure 2. *Staphylococcus* measurement chart

Fungi

Based on the results of the study by measuring the number of fungi, the results are shown in the Table 3.

Table 3. Research measurement results of fungi

No	Cassette code	Pre-test (CFU/gram)	Post-test (CFU/gram)
1	A1	5	1
2	A2	0	0
3	A3	0	0
4	A4	1	1
5	B1	0	0
6	B2	0	0
7	B3	5	2
8	B4	2	2
9	C1	0	0
10	C2	0	0
11	C3	0	0
12	C4	1	1

Code A : Cassette size 18x24 cm; Code B : Cassette size 24x30 cm; Code C : Cassette size 30x40 cm

Based on the Table 3, it can be seen that there is a significant decrease in the number of fungi on radiographic cassettes after being given treatment in the form of betel leaf oil smearing. A comparison graph of the pre-test and post-test on fungi measurements can be seen in the Figure 3.

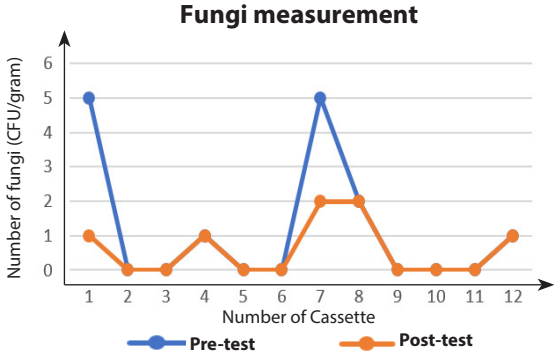

Figure 3. Fungi measurement chart

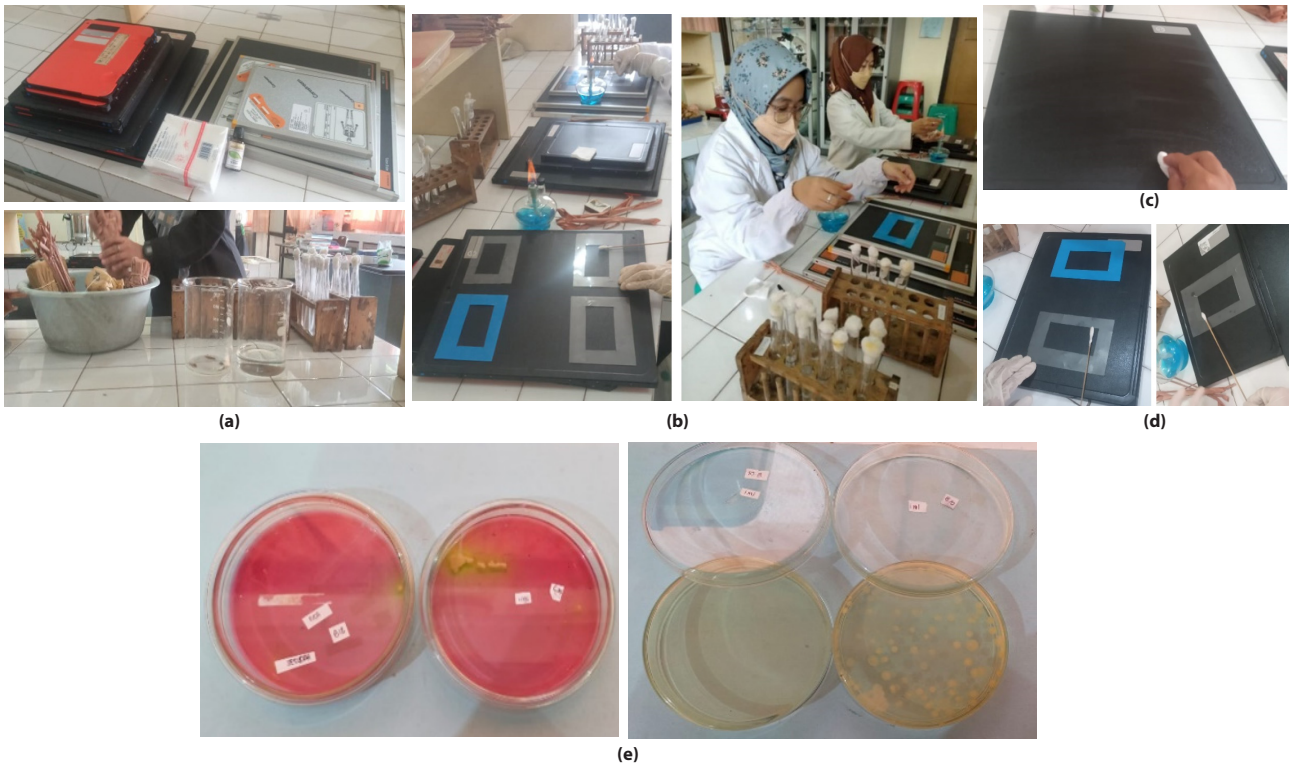

Figure 4. (a) Preparation of tools and materials, (b) Pre-treatment sampling, (c) Wiping treatment with betel leaf oil, (d) Sampling after treatment, (e) Calculation of the number of microbes pre and post treatment after incubation for 2 x 24 hours

DISCUSSION

Nosocomial infection has many causes, one of which is by touching equipment and objects related to patients in the hospital (Darmadi, 2008; JY and JK, 2020). Based on research from Dartini *et al*. (2017), it was mentioned that using chlorine solution as a disinfection material on radiographic cassettes is effectively 2% better than using alcohol with a content of 70%. In this study, researchers used betel leaf oil with the consideration that it is a natural ingredient, easy to obtain in Indonesia, and the use of local wisdom as a material of value in the community, besides that because it is a natural ingredient, it will not provide side effects in the form of irritation to the skin or damage the surface on the radiographic cassettes (Emrizal *et al*., 2014; Rahayu *et al*., 2019; Melgar *et al*., 2022; Thi *et al*., 2021).

Based on the study's results, in measuring the TPC obtained, the average result of a decrease in TPC value after radiographic cassettes were given treatment in the form of betel oil was 17.8%. In *Staphylococcus* measurements, the average result of a decrease in *Staphylococcus* values after radiographic cassettes were treated in the form of betel leaf oil was 57.41%. In fungi measurements, the average result of a decrease in fungi values after radiographic cassettes were given treatment in the form of betel oil was 37.21%. Essential oil from betel leaf oil contains betlephenol and chavicol, which have germ-killing, anti-oxidation, and fungicidal or anti-fungal power (Madhumit *et al*., 2019 ; Idris Chin and Karim, 2020).Based on literature from various journals, it is stated that this chavicol compound has the most significant role in suppressing the number of microbes on radiographic cassettes. This is in accordance with the results of this study that betel leaf oil can stop bacteria in the form of *Staphylococcus*, which is relatively high on cassettes with a decrease in the amount of 57.41% compared to before being treated with betel leaf oil (Ali *et al*., 2018 ; Anugrahwati *et al*., 2016; Fohely *et al*., 2021).

In this study, several measurement results were of the same value between the pre-test and post-test, this was likely due to the taking of the same that was not in a sterile room, so it is expected that the results were due to many environmental factors that interfered with the measurement (Basit *et al*., 2020; Lee *et al*., 2022; Savsani *et al*., 2020; Shah and Jhade, 2018; Wirasuta *et al*., 2017). This research has shortcomings because data collection was still during the Covid-19 pandemic. There are limitations in data collection in hospitals. Then, the radiographic cassette used as a research sample was in the Purwokerto Radiology Study Program Laboratory (Melgar *et al*., 2022; Trunga *et al*., 2021), whose use is only by students for practice in the lab. This is likely to cause the number of microbes that exist when research needs to be more accurate according to the number of radiographic cassettes commonly used in patient services at the Radiology Installation.

CONCLUSION

Based on the results of the study, it can be concluded that the use of betel leaf oil as disinfection on radiographic cassettes is quite effective in suppressing the activity and number of microbes on radiographic cassettes with a concentration of 75% so that it can be used as an alternative natural disinfection material for the prevention of nosocomial infections both in radiology installations and in hospitals. The limitation of this study is the small number of cassette samples and the variety of cassette types. Suggestions for further research are that more research is needed regarding radiological equipment other than radiographic cassettes, for example in areas with frequent contact with patients.

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