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THE POTENTIAL OF VIRGIN COCONUT OIL (VCO) CAN INHIBIT THE DEVELOPMENT OF TUBERCULOSIS BACTERIA

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VCO

P e n u l i s K o r e s p o n d e n s i

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A B S T R A C T

Virgin Coconut Oil (VCO) contains biochemical components, namely peptides called bacteriocins and can inhibit the growth of pathogenic bacteria. Tuberculosis (TB) is a disease caused by the pathogenic bacterium Mycobacterium tuberculosis. It has been widely studied that the potential of VCO to inhibit the growth of pathogenic bacteria such as inhibiting the growth of bacteria that cause Otitis Media Suppurative Khronis, such as Staphilocoous aureus, Staphilococcus edpidermidis, Klebsiella, Proteus, Pseudomanas aureginosa and others. But not many have studied the potential of Virgin Coconut oil to inhibit the growth of pathogenic bacteria that cause tuberculosis. Tuberculosis is very dangerous, because it attacks the lungs and other parts of the body, and is the leading cause of death worldwide. If VCO has the potential to inhibit the growth of pathogenic bacteria that cause tuberculosis, then the risk of death can be reduced. The purpose of this study is to study the potential of virgin coconut oil (VCO) to inhibit the development of tuberculosis bacteria. This research was conducted at the Chemistry Laboratory and Molecular Biology Laboratory of Perintis University Indonesia. The sample was the sputum of 5 TB patients from Pariaman Hospital, to be isolated for pathogenic bacteria. VCO is made by fermentation without the addition of a stater. It turns out that the bacteria isolated from sputum are Mycobacterium tuberculosis. VCO has the ability to inhibit the bacteria that cause tuberculosis, according to its concentration, the largest is at a concentration of 100%.

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Jurnal Katalisator Vol 9 No. 1 (2024) 226-236

Its antioxidant ability is among the weak ones. In general, VCO can be concluded that VCO has the potential to reduce the consequences of death.

INTRODUCTION

Nowadays, many herbal medicines are used to prevent various diseases. One of them, virgin coconut oil (VCO), is suspected to be used as a therapy for UC (Ulcerative Colitis). This disease is an inflammation of the colon characterized by diffuse mucosal damage accompanied by ulceration. In this disease, what is damaged is pro-inflammatory cytokines. The administration of VCO supplementation can be used to prevent ulcerative colitis by increasing IL-10 levels while reducing IL-6, TNF-α, DAI, and MKHI scores. These effects can be induced by compounds in VCO that have the potential to be anti-inflammatory and antioxidant.(Trismayanti *et al.*, 2023), (Devriany *et al.*, 2021), (Salas *et al.*, 2018).

Likewise, VCO has been used to help cure covid-19 patients (Angeles-Agdeppa *et al.*, 2024),(Angeles-Agdeppa *et al.*, 2021), (Hartono *et al.*, 2022), (Annisa and Rosyid, 2023) where a clinical study conducted in 2020 found that virgin coconut oil (VCO) can quickly relieve COVID-19 symptoms and normalize C-reactive protein (CRP) concentrations. VCO can be used as an additional supplement in people with COVID-19 cases because of its anti-viral and immunomodulatory props. In addition, Curcumin combined with VCO can be a nutraceutical source for the recovery of COVID-19 patients.

Virgin Coconut Oil can be fused as an antimicrobial as has been studied (Hartati *et al.*, 2019), that Virgin Coconut Oil combined with Swietenia mahagoni seed extract has antimicrobial activity against *Escherichia, Staphylococcus aureus, Bacillus subtilis dan Candida albicans* high. Its antioxidant ability is also high.

The addition of VCO inhibits the growth of *Listeria monocytogenes, Staphylococcus aureus and Escherichia.* (Fangfang *et al.*, 2020), (Suryani *et al.*, 2020), (Suryani *et al.*, 2023) and inhibit bacteria *Streptomyces cacaoi, Escherichia coli, Pseudomonas aeruginosa, Enterococcus spp, Vibrio cholerae Enterobacteriaceae, Pneumococci and Staphylococcus aureus.* Selain itu juga dapat menghambat bakteri (Widianingrum, Noviandi and Salasia, 2019),(Haron *et al.*, 2019) *Staphylococcus aureus* dan *S. mutans*.

Tuberculosis is caused by pathogenic bacteria. *Microbacterium Tuberculosis* (Perulli *et al.*, 2024), (Parlin and Hamidy, 2021) This is the main cause in humans, while it can also be caused by *Mycobacterium bovis,* causes tuberculosis in animals, such as cattle, but can also infect humans, *Mycobacterium africanum,* found in some parts of West Africa and can cause tuberculosis in humans, *Mycobacterium microti,* usually infects small animals, but in rare cases, it can cause tuberculosis also in humans and *Mycobacterium canettii*. is mainly found in East Africa and can also cause tuberculosis in humans, although rarely.

Found in a 3-year-old boy, who is from Djibouti, tuberculosis caused by *Mycobacterium canettii*. Where this pathogenic bacteria can very rarely infect humans. This infection develops 2 months and is in Lymphopathy tuberculosis. Mycobacterium canettii, this strange species of complex Mycobacterium tuberculosis (Faury *et al.*, 2023), (Sabin *et al.*, 2022), (Madacki *et al.*, 2021). *Mycobacterium canettii* is a fine bacillus associated with

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Jurnal Katalisator Vol 9 No. 1 (2024) 226-236

the complex Mycobacterium tuberculosis. It causes lymph nodes and pulmonary tuberculosis in patients living in Horn of Africa countries, including Djibouti.(Loukil *et al.*, 2019)

Tuberculosis is the leading cause of death in the world.(Efrizon, Fenti and Erni, 2019), because tuberculosis is the ninth leading cause of death worldwide and the leading cause of a single infectious agent (Yetti R., Tombeg and J. Hadi, 2023), (Yetti R., Tombeg and J. Hadi, 2023), Tuberculosis is one of the infectious diseases that is still a major health problem in the world. Despite significant prevention and treatment efforts, TB remains the leading cause of death in many countries, as well as around the world (Ruseesa, Simbi and Ntaganira, 2023), (Ashenafi Abate Woya, 2019).

TB can be in a latent state. This means that a person can be infected with TB bacteria without showing any symptoms and is not contagious. However, they are at risk of developing active tuberculosis in the future, especially if their immune systems are weakened.(Putra Gofur, 2022), (Kaswandani, Jasin and Nugroho, 2022). Children can also get tuberculosis, but the diagnosis is often difficult because the symptoms can be different from adults and are often non-specific. Childhood TB is often overlooked or mistaken for another disease.

Multidrug-resistant TB (MDR-TB) and very broadly resistant TB (XDR-TB) are forms of TB that are difficult to treat because the bacteria that cause them are resistant to drugs that are usually used to treat TB. Treatment of MDR-TB and XDR-TB takes longer and the use of stronger drugs with more severe side effects.

HIV and TB co-infection: TB is the most common opportunistic infection among people living with HIV. A weakened immune system in people with HIV increases the risk of developing active tuberculosis. Treatment of TB in people with HIV requires a special approach due to the interaction between anti-TB drugs and antiretrovirals.(Rambaran *et al.*, 2023), (du Bruyn *et al.*, 2023).

Sometimes tuberculosis can affect organs other than the lungs, such as bones (bone tuberculosis) and the central nervous system (TBC meningitis)(Simmons *et al.*, 2023),(Navasardyan *et al.*, 2023).

If VCO has the potential to inhibit the development of this tuberculosis-causing pathogenic bacteria, and can even kill it, it will reduce the consequences of death.

Likewise, if VCO is able to kill the pathogenic bacteria that cause tuberculosis, then resistance to this bacteria can be overcome.

So the purpose of this study is to study the potential of virgin coconut oil (VCO) to inhibit the development of tuberculosis bacteria.

RESEARCH METHODS

This research was conducted at the Chemistry Laboratory and Molecular Biology Laboratory of Perintis University Indonesia. The sample was the sputum of 5 TB patients from Pariaman Hospital, to be isolated for pathogenic bacteria. VCO is made by fermentation

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Jurnal Katalisator Vol 9 No. 1 (2024) 226-236

without the addition of a stater. The TB pathogenic bacteria were isolated, identified and analyzed for antibacterial VCO against the bacteria that cause TB. VCO antioxidant analysis.

For the isolation of pathogenic bacteria that cause tuberculosis disease, sputum of TB patients is used at Pariaman Hospital. And for the VCO, VCO is used which is made by fermenting coconut milk with the addition of a stater.

Instrument

The tools used are in addition to glassware such as petri dishes, test tubes, Erlenmeyer, beker glass (pyrex) are also used Laminair Flow whose brand is Laminar Flow Clean Bench – Gold Models_ (Horizontal Air Flow Type), autoclave Model: LS-100LJ, Shimadzu Spectrophotometer UV VIS Reflectance Measurement Kit 200-63687.

Chemical

The chemical substances used are other than the usual chemical substances such as aquades, technical alcohol solvents, NaCl 96%, NA media, Metahol pa, Mc Farlan 0.5; DPPH.

Procedure

Isolation of pathogenic bacteria that cause tuberculosis

Sputum was taken from tuberculosis patients at the Padang Pariaman Regional Hospital, then diluted with saline. To homogenize and make it dilute, buffers and enzymes are added. The medium used by Löwenstein–Jensen, better known as LJ medium, is a growth medium specifically used for the culture of Mycobacterium species, especially Mycobacterium tuberculosis.

Identification of pathogenic bacteria that cause tuberculosis

Identification of Mycobacterium is carried out by acid-fast staining such as Ziehl-Neelsen, or fluorescence staining using auramin

Analysis of antimicrobial VCO with bacteria test for pathogenic bacteria that cause tuberculosis.

Determination of antimicrobial activity by agar diffusion method is a commonly used technique to evaluate the effectiveness of an antimicrobial agent against specific microorganisms. Here are the general steps in this procedure

a. Preparation of agar media

- The medium for LJ nutrients or medium is prepared and poured into sterile Petri dishes until it hardens.
- The medium is allowed to harden at room temperature.

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Jurnal Katalisator Vol 9 No. 1 (2024) 226-236

b. Inoculation of Microorganisms

- Cultures of test microorganisms (usually bacteria) are grown overnight in liquid medium
- The suspension of microorganisms adjusted to a specific concentration standard (e.g., McFarland's standard) is spread evenly over the surface to use cotton wrapped around a sterile toothpick

c. Application of VCO as Antimicrobial

- VCO as an antimicrobial to be tested is placed on agar in the form of (disc 0 modified filter paper such as a disc dipped in an antimicrobial VCO solution
- A disc made of filter paper containing VCO as an antimicrobial is placed on top of the agar that has been inoculated with microorganisms. The disc paper is pressed slightly so that it is in good contact with the agar.

d. Incubation

- The prepared Petri dishes are incubated at 37°C for 24 hours or overnight.

e. Observation and Measuring

- After the incubation period, the dish is examined for an inhibition zone (a bacterial growth-free area) around the disc-shaped filter paper.
- Diameter of the inhibition zone is measured with a ruler in millimeters.
- The larger the inhibition zone, the more effective the antimicrobial agent is against the microorganism being tested.

f. Interpretation of Results

- Diameter of the inhibition zone is compared to the established standard.

Determination of VCO Antioxidant Activity

Once the inoculum medium is available, the sterile disc is implanted into the test medium with sterile tweezers. A 10 µL micropipette is used to pipette the sample solution with each concentration, then drip onto the disc. Petri dishes are closed and incubated for 24 hours at 25oC. Using a caliper, the growth inhibition of the test microbes is observed and measured in diameter. The data were obtained in the form of resistance diameter areas.

Each 100 mg of VCO is dissolved with methanol to the limit mark in a 100 ml measuring flask for the manufacture of the parent solution, which has a concentration of 1000 ppm of the parent solution. Pipetted 1.5. 3. 4,5. 6. 7.5 (ml). Methanol is added in the flask to the cut-off mark. Be the concentration of the sample (150, 300, 450, 600, 750 ppm). Pipette 2 ml of each extract, put into a vial and add DPPH 35 ppm, homogenize and then let it sit for 30 minutes in a dark place. Finally, it was measured with a UV-Vis spectrophotometer.

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Jurnal Katalisator Vol 9 No. 1 (2024) 226-236

RESULTS AND DISCUSSION

The study was conducted by taking samples from the sperm of 5 patients, all of whom had a history of TB insfeki or suffered from TB disease, data from these patients could be presented such as:

next

Table 1. Demographic and Clinical Characteristics of the Sample

Sample No	Gender (Male /Female)		Age (years)	Outpatient
1.	M		56	ν
2.		F	37	ν
3.	M		45	x
4.	M		67	ν
5.		F	42	ν
	% M = 60%	% F = 40%	Average age = 49,4 year	80%

From Table 1, regarding the demographic characteristics and clinical data of patients, it can be explained that the sample is 60% male2 and the average age is 49.4 years and 80% are outpatients. When compared to other studies such as several studies that isolated the pathogenic bacteria that cause tuberculosis conducted in Ethiopia and Tanzania using phlegm culture techniques and the use of GeneXpert technology from conventional bacteriological cultures helped to detect TB and other bacteria in clinical samples, as well as identify bacterial species such as Mycobacterium tuberculosis and other pathogens in TB cases (Buchera *et al.*, 2022), collected a sample of 264 patients who had demographic and clinical data with an average age of 36.6 years, 59% male (L), and in general outpatients and all are TB patients.

Isolation of pathogenic bacteria that cause tuberculosis and Identification of pathogenic bacteria that cause tuberculosis

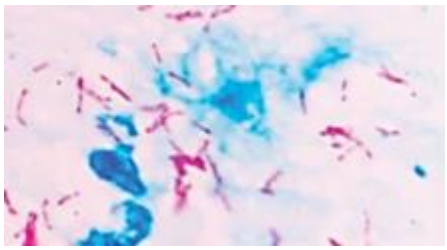

Figure 1. Results of isolation microscopy of pathogenic bacteria that cause TB

Figure 1. Showing the results of the microscope of the pathogenic bacteria that cause tuberculosis. Where the red ones like rods are the pathogenic bacterial cells and the blue ones

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Jurnal Katalisator Vol 9 No. 1 (2024) 226-236

are not. It turned out that all the samples found were *M tuberculosis bacteria.* Also in accordance with (Buchera *et al.*, 2022), In this study, almost all of them had *M. tuberculosis,* although there were a small number of *Klebsiela pneumonia,* and *S. pnemonia*. But on (Quigley *et al.*, 2020) Marfomycin was found, whose structure is still being studied.

Analysis of antimicrobial VCO with bacteria test for pathogenic bacteria that cause tuberculosis.

Antimicrobial analysis of Virgin Coconut Oil on Mycobacterium tuberculosis bacteria isolated from sputum (sample), is as follows Table 2 Results of antimicrobial analysis of Virgin Coconut Oil against Mycobacterium tuberculosis bacteria.

Tabel 2. Results of Antimicrobial Analysis of Virgin Coconut Oil against Mycobacterium tuberculosis bacteria

No	Virgin Coconut Oil (%)	Diameter of the resistance(mm)
1	20	10
2	40	12
3	60	18
4	80	22
5	100	26

From table 2, it can be seen that Virgin Coconut Oil has a growth inhibitory power against M. tuberculosis bacteria which increases based on the concentration of VCO given. It is also in accordance with the (Suryani *et al.*, 2020), (Widianingrum *et al.*, 2023), which also conducts antimicrobial analysis from VCO, against pathogenic bacteria.

Analysis of VCO Antioxidant Activity

Table 3. Results of Analysis of Antioxidant Activity of VCO Preparations

Concentration (ppm)	Absorban control	Absorban vco + DPPH	Inhibisi (%)	IC_{50} (ppm)
150 ppm	0,656	0,531	19,05 %	583,92 ppm (Very Weak)
300 ppm	0,656	0,458	30,18 %	
450 ppm	0,656	0,392	40,24 %	
600 ppm	0,656	0,317	51,67 %	
750 ppm	0,656	0,253	61,,43 %	

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Jurnal Katalisator Vol 9 No. 1 (2024) 226-236

Keterangan :

0 – 50 ppm Aktivitas Antioksidan Golongan Sangat Kuat

50 – 100 ppm Aktivitas Antioksidan Golongan Kuat

100 – 150 ppm Aktivitas Antioksidan Golongan Lemah

150 - >200 ppm Aktivitas Antioksidan Golongan Sangat Lemah

From Table 3, it can be said that the results of the antioxidant analysis from VCO are very weak. This can happen, it is possible that there is an error from the reading of the UV spectrophotometer that has not been calibrated. But supposedly Virgin Coconut Oil (VCO) is rich in antioxidants such as tocopherols, phenolic compounds, and beta-carotene, contributing to its powerful antioxidant properties. The phenolic content in VCOs, including tocopherols, sterols, and flavonoids, plays an important role in their antioxidant function (E. M. NIVYA *et al.*, 2023).,

CONCLUSION

It can be concluded that VCO can potentially be a supplement that inhibits the development of tuberculosis. Based on the analysis of the antimicrobial ability of VCO against pathogenic bacteria that have been isolated and identified as the cause of tuberculosis, and the analysis of VCO antioxidants must be repeated, which should be strong.

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