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DIFFERENCE IN EFFECTIVENESS OF ACUPRESSURE WITH A MIXTURE OF GINGER AND LEMON EXTRACTS ON REDUCING ANTI-TUBERCULOSIS DRUG SIDE EFFECTS

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ABSTRACT

Introduction: *Tuberculosis is a disease that attacks the lungs and several other organs caused by Mycobacterium tuberculosis. Tuberculosis remains a global health issue in developing countries, including Indonesia. Anti-tuberculosis drugs are the most important part of pulmonary TB treatment, but these medications often cause side effects. If not controlled, they can cause discomfort and worsen the patient's condition. Acupressure and the administration of ginger and lemon extract serve as non-pharmacotherapy complements to help reduce the side effects of anti-tuberculosis drugs.* ***Methods:*** *This study is quasi-experimental with a two-group pretest-posttest approach involving 30 participants. Acupressure was administered for 7 minutes per day, while a mixture of ginger and lemon extract was given at 8 grams per day. The intervention was provided for four weeks. Body weight was measured using a digital scale, nausea and vomiting were measured using the Rhodes index of nausea, vomiting, and retching, and joint pain was measured using the numeric pain scale.* ***Results:*** *nausea and vomiting with a p-value of 0.00 before and after the treatment. The post-treatment difference test between the two groups did not show significant differences (> 0.05) with a low difference.* ***Conclusions:*** *The administration of acupressure and ginger and lemon extract can help reduce the side effects of tuberculosis treatment*

Introduction

For more than ten years, tuberculosis has been a major health issue in various countries, including Indonesia. Indonesia has become the country with the second-highest tuberculosis cases after India and contributes 10% of the global tuberculosis cases. So far, anti-tuberculosis drugs (ATD) are the most important part of treating pulmonary TB. Pulmonary TB treatment involves administering a minimum of four types of drugs divided into two phases: the initial phase and the continuation phase. This treatment takes six months. The success of tuberculosis treatment is influenced by the patient's adherence to taking medication (Rasdianah et al., 2022; World Health Organization, 2020)

The success rate of tuberculosis treatment in Indonesia is 82.7%. This figure has not reached the target set, which is >90%. Treatment failure in tuberculosis can be caused by the premature cessation of treatment. The influencing factors include the side effects of anti-tuberculosis drugs and patients feeling better after the initial stage of treatment. The side effects that often occur include nausea, vomiting, loss of appetite, joint pain, tingling, and reddish-colored urine. If not controlled, it will cause discomfort and worsen the patient's condition. Failure due to side effects of anti-tuberculosis drugs that are not promptly addressed can reduce treatment success rates, trigger antibiotic resistance, and even lead to death (Afshar et al., 2023; Kemenkes RI, 2020).

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The development of technology has led to several solutions for health problems in tuberculosis patients, but there is a lack of discussion on the side effects of ATD. One solution that can be offered for the independence of tuberculosis treatment is through non-pharmacotherapy complements. Currently, non-pharmacotherapy treatments have become a popular choice among the public. This is because non-pharmacotherapy has low side effects and is more accessible. Herbal plants have become one of the most chosen complementary treatments as an effort to cure diseases and reduce the side effects of using chemical drugs. Popular herbal plants include ginger and lemon (Fujiati et al., 2022; Kumar Mishra & Shukla, 2020)

Ginger (Zingiber Officinale) contains essential oils such as zingiberene (zingirona), zingiberol, bisabilene, curcumen, gingerol, farnesene, vitamin A, and bitter resin. The essential oil content has a refreshing effect and stops the vomiting reflex. In addition, it can also effectively improve blood circulation and nerve function, thereby reducing tension, refreshing the mind, and alleviating sensations of nausea and vomiting. The limonene content in lemons can reduce pain and nausea by inhibiting the function of prostaglandins. The consumption of a mixture of ginger and lemon extract is expected to be a solution to reduce the side effects of anti-tuberculosis drugs (Bhaskar et al., 2020; Kumar Mishra & Shukla, 2020)

In addition to herbal plants, there is acupressure management, which has become a trend and a new paradigm to support a healthy and prosperous life. Acupressure is a mechanical pressure technique based on acupuncture points. This technique has the advantages of being simple, inexpensive, non-invasive, easy to perform, and has been proven effective in many medical conditions. In line with the national tuberculosis control strategy, there is a need for multisectoral involvement in the development of tuberculosis treatment (Fitriani et al., 2023; Saputra ramal, 2022)

Both complementary treatments are easy for a tuberculosis patient to perform independently to support the success of the treatment. There has been no research examining the differences between these two treatments and exploring complementary options that could help reduce the side effects of anti-tuberculosis drugs. In this case, the researchers conducted tests on two different groups of tuberculosis patients undergoing six months of tuberculosis treatment.The aim of this study is to examine the difference in effectiveness between acupressure with a mixture of ginger and lemon extract in reducing the side effects of anti-tuberculosis drugs (ATD) in tuberculosis patients.

Methods

This research is a quantitative study using a quasi-experimental design with a two groups independent pretest-posttest approach, which involves observing the differences between two independent groups. The population in this study consists of tuberculosis patients undergoing anti-tuberculosis treatment for six months. The sampling technique in this study is non-probability sampling using purposive sampling. The sample used consisted of 15 respondents for each group. The first group is the treatment group consuming a mixture of ginger and lemon extract, while the second group is the acupressure treatment group. The researchers set the inclusion criteria for the sample, including being over 20 years old, having a positive pulmonary TB diagnosis, and not having allergies to lemon and ginger. (Sastroasmoro, 2014; Wijaya & Makiyah, 2021). The research location includes the working area of community health centers in Bantul Regency. This research was conducted from September to November 2024. The Intervention of acupressure was done for 7 minutes per day, and the consumption of ginger and lemon extract was 8 grams per day for each of the four weeks. Weight measurement was conducted using a digital scale, joint pain measurement using the Numeric Pain Scale, and nausea and vomiting measurement using the Rhodes Index Nausea Vomiting and Retching. Analysis of the average difference before and after the intervention used the Paired t-test for body weight

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and the Wilcoxon test for joint pain, nausea and vomiting. Analysis of the difference in results between the two groups used the Independent sample t-test for body weight and the Mann Whitney-U test for joint pain, nausea and vomiting with a confidence level of 95%.

Results

Table 1. Respondent Characteristics

Characteristic	Frequency	Persentage %
Age :		
20 – 44	14	46,7
45 – 59	13	43,3
60 – 76	3	10
Gender :		
Male	18	60
Female	12	40
Treatment stage :		
1 – 2 Months	11	36,7
3 – 6 Months	19	63,3

The characteristics of the respondents by age are still classified as being in the productive age group. Ages 20 – 44 years in the intervention group amounted to 14 people (46.7%). The majority of respondents by gender were male, totaling 18 people (60%). The duration of treatment for some respondents had already entered the advanced treatment stage (3-6 months), totaling 19 people (63.3%).

Table 2. Results Of The Difference Test For Average Scores Of Body Weight, Joint Pain, Nausea, And Vomiting In Tuberculosis Patients Before And After Intervention

Variable	Group	Pre-test Mean±SD	Post-test Mean±SD	*ρ value*
Weight	Acupressure	49,8±7,11	54,0±5,40	0,000
	Lemon and Ginger Extract	49,6±6,87	52,4±6,77	0,000
Joint Pain	Acupressure	3,00±0,65	1,00±0,00	0,000
	Lemon and Ginger Extract	2,67±0,61	1,07±0,25	0,000
Nausea and Vomiting	Acupressure	2,20±0,56	1,00±0,00	0,001
	Lemon and Ginger Extract	2,13±0,51	1,00±0,00	0,000

Table 2 reveals the differences in average scores for body weight, joint pain, nausea and vomiting pre-test and post-test acupressure and ginger-lemon extract Intervention. In the acupressure group, there was an increase in body weight and a decrease in joint pain with a significance value of 0.00 (< 0.05), while the decrease in nausea and vomiting showed a significance value of 0.01. Similarly, in the ginger-lemon extract group, there was an increase in body weight, a decrease in joint pain, and a decrease in nausea/vomiting with a significance value of 0.00 (<0.05).

Table 3. Results Of The Difference Test In Average Scores Of Body Weight, Joint Pain, Nausea, And Vomiting In Tuberculosis Patients In The Acupressure Group With Ginger And Lemon Extract After Intervention

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Variable	Group	Mean	Mean Difference	*ρ value*
Weight	Acupressure	54,0	1,61	0,477
	Lemon and Ginger Extract	52,4		
Joint Pain	Acupressure	1,00	0,07	0,317
	Lemon and Ginger Extract	1,07		
Nausea and Vomiting	Acupressure	1,00	0,00	1,00
	Lemon and Ginger Extract	1,00		

Table 3 reveals there are no differences in the average scores of body weight, joint pain, and nausea and vomiting between the acupressure group and the ginger and lemon extract group. The weight variable was tested using the Independent Sample t-test and obtained a ρ value of 0.477. The joint pain, nausea, and vomiting variables were tested using the Mann Whitney-U test, each showing ρ values of 0.317 and 1.000, respectively. In weight gain, there is a difference of 1.61 between the acupressure group and the ginger and lemon extract group. In joint pain, there is a difference of 0.07, and in nausea and vomiting, there is no difference between the two groups.

Discussion

The Intervention of acupressure with ginger and lemon extract in this study has been proven to show weight gain, reduce joint pain, and alleviate nausea and vomiting due to the side effects of ATD treatment in tuberculosis patients. Patients who experiences side effects will be prescribed antiemetic medication and vitamins to prevent the possibility of discontinuing medication, so the administration of acupressure with ginger and lemon extract is a complementary treatment to help reduce the severity of side effects. This study provides interventions to two groups with different treatments for each. Acupressure therapy was administered at the Nei Guan, Zu San Li, Zhong Wan, and Yin Ling Quan points for 7 minutes each day. The researchers provided a tool in the form of gloves with roller ball at the fingertips to assist respondents in applying pressure to acupressure points. However, this tool still needs to be re-evaluated regarding its effectiveness and ease of use. In a different group, a mixture of ginger extract and lemon powder was consumed at a dose of 8 grams per day, dissolved in 200 ml of warm water.

1. Weight Gain

The side effects of tuberculosis treatment are often experienced by patients in the early stages of treatment. Some of the side effects that are commonly experienced are nausea, vomiting, joint pain, loss of appetite, and reddish urine. The side effects of nausea and vomiting can also lead to a decrease in appetite, resulting in significant weight loss. The cause of these metabolic changes is suspected to be the proinflammatory cytokines secreted by immune cells in response to the immune reaction against pulmonary TB bacterial infection. The impact can result in chronic energy deficiency. Decreased appetite also occurs due to the side effects of anti-tuberculosis drug treatment, which cause nausea and vomiting, leading TB patients to experience a loss of muscle and fat mass (Afshar et al., 2023; Ellyse et al., 2019; Rasdianah et al., 2022). The worsening prognosis in tuberculosis patients may have a causal relationship. Significant weight loss is related to the effects of nausea and vomiting that may

have occurred previously. Nausea and vomiting that occur more than three times a day can also cause pain in the abdominal muscles and liver. This can worsen with a decrease in appetite, leading to a drastic weight loss. Thus, the success of management in one clinical case may be followed by improvements in other clinical cases.

There was a significant weight gain in both the acupressure group and the ginger and lemon extract group. This weight gain is acknowledged as a result of the reduction in nausea and vomiting that are often complained about by tuberculosis patients, especially those undergoing the intensive phase. The gradually increasing appetite affects nutritional needs, leading to a positive impact on clinical weight improvement.

2. Lowering of Joint Pain

Joint pain generally occurs in the lower musculoskeletal system, although some experience abdominal pain due to medication side effects or severe nausea and vomiting. Pain is an unpleasant sensory and emotional experience resulting from actual or potential tissue damage and is the main reason someone seeks healthcare assistance. One of the anti-tuberculosis drugs that can cause joint pain is Pyrazinamide, which can occur due to decreased excretion and accumulation of uric acid. Acupressure intervention with ginger and lemon extract showed a significant reduction in joint pain among respondents. Acupressure intervention showed a significant reduction in joint pain.

The acupressure points given for joint pain are the Zu San Li, Yin Ling Quan, and Zhong Su points. Acupressure is one of the various complementary therapies with a non-invasive touch modality. Acupressure is administered by applying massage or pressure to specific points. In acupressure therapy, the massage can be done using the fingers (thumb or index finger) (Fitriani et al., 2023). Acupressure is also one of the complementary treatments that still exists and is believed by the community to alleviate musculoskeletal pain.

The intervention of ginger and lemon extract also resulted in a reduction in joint pain. Ginger has been used as an anti-inflammatory and anti-rheumatic for musculoskeletal pain. The use of ginger is claimed to be safe for its pain-reducing effects. Additionally, ginger is easy to find because it is a very important Indonesian spice in daily life, especially in the field of health.

3. Lowering of Nausea and Vomiting

Nausea is a side effect often experienced by patients after taking medication. It is generally experienced by patients undergoing intensive treatment. The drug that causes the side effect of nausea is isoniazid. The mechanism of action of isoniazid is that it affects the biosynthesis processes of lipids, proteins, nucleic acids, and glycolysis. The main action of isoniazid is to inhibit the biosynthesis of mycolic acid, which has important constituents in the cell wall of mycobacteria. Changes in the biosynthesis of the above compounds occur due to the formation of an inactive drug-enzyme complex. The inactivity of this enzyme occurs through the mechanism of alteration of nicotinamide in the enzyme by isoniazid.

The Interventions of interventions with ginger and lemon extracts each provide positive effects in reducing nausea and vomiting. In patients who experience nausea as a side effect at the beginning of treatment, antiemetics will be prescribed to prevent discontinuation of treatment. The administration of antiemetics can help accelerate the reduction of nausea in addition to complementary interventions. The acupressure points given to reduce nausea are the Nei Guan, Shou San Li, and Hong Wan points. These points alleviate stomach-related disorders such as nausea and vomiting, diarrhea, and epigastric pain. This study is in line with

the research by Tan et al. (2022), where there was a significant difference in the intervention group with a p-value of 0.001 (<0.005). The intervention group experienced a greater reduction in nausea and vomiting compared to the control group.

4. The Difference in Effectiveness of Acupressure with a Mixture of Ginger and Lemon Extract

In the acupressure group with the ginger and lemon extract group, there was no significant difference and a low difference, but there was an improvement in each group before and after the treatment. This indicates that both acupressure and ginger and lemon extract provide almost the same positive effect. The administration of acupressure and ginger-lemon extract can be a complementary therapy option to help reduce the side effects of anti-tuberculosis drug treatment and improve the clinical condition of tuberculosis patients.

Ginger (Zingiber Officinale) has long been widely used to treat various diseases and is one of the most popular herbal dietary supplements in the world. Ginger contains essential oils such as zingiberene (zingirona), zingiberol, bisabilena, curcumen, gingerol, farnesene, vitamin A, and bitter resin. The content of essential oils has a refreshing effect and stops the vomiting reflex. In addition, it is also capable of effectively improving blood circulation and nerve function, thereby reducing tension, refreshing the mind, and alleviating sensations of nausea and vomiting. Z. officinale has long been widely used as an herbal remedy for the prevention and treatment of various diseases, as it has also been reported to show no toxic effects . (Kim et al., 2022; Kusumaningsih, 2022; Morvaridzadeh et al., 2020)

The components of Z. officinale include volatile oils, fixed oils, and pungent compounds, but they depend on the characteristics of the cultivation area and agroclimatic conditions. As pungent compounds, [6]-gingerol and [6]-shogaol are the two main compounds. When gingerol, which is unstable at high temperatures, is deformed at high temperatures, it becomes shogaol, and [6]-shogaol is the most common dehydrated product. Although the content of [6]-gingerol and [6]-shogaol in Z. officinale appears to be influenced by drying and extraction temperatures, it has been reported that approximately 11% and 0.08% are contained in Z. officinale, respectively. Both shogaol and gingerol are known to easily cross the blood-brain barrier. Research conducted by Gauthier et al. reported that [6]-gingerol can effectively reduce mechanical pain induced by CCI. Pain lasted from 1 to 10 days after surgery, and the intrathecal administration of 10 μg [6]-gingerol showed analgesic effects, lasting up to 4 hours after injection. In the study by Mata-Bermudez et al., the same dose of [6]-gingerol also reduced mechanical pain induced by SNL. The anti-analgesic effect of [6]-gingerol began 60 minutes after administration, gradually decreasing after four hours. They further reported that various serotonin receptors (5-HT), such as 5-HT1A, 1B, 1D, and 5A, are involved in the analgesic effects of [6]-shogaol (Anh et al., 2020; Kim et al., 2022)

Lemon is renowned for its excellence in various characteristics including food, nutrition, and herbal use. The skin and juice of lemons contain antioxidants. Limonene is the main component of lemon essential oil and gives it a distinctive scent. This can be found in its peel. This aroma helps alleviate gastric acid reflex and nausea by inhibiting the function of prostaglandins, as well as strengthening blood vessels and preventing atherosclerosis. Ascorbic acid and other antioxidant variants in lemon help strengthen the body's defense system against viruses and bacteria. A soothing drink made by adding one lemon to a glass of

hot water with a tablespoon of honey is very good for someone experiencing a cough or cold (Singh Jakhar, 2021; Talib, 2017)

Conclusion

There were differences in average body weight, joint pain, and nausea and vomiting between the acupressure group and the ginger and lemon extract group before and after treatment. There were no significant differences between the acupressure group and the ginger and lemon extract group, indicating a low difference. The intervention of acupressure and ginger-lemon extract can be complementary therapy options to help reduce the side effects of TB treatment and improve the clinical condition of tuberculosis patients.

Ethics approval and consent to participate

This research involves tuberculosis patients undergoing anti-tuberculosis treatment and has been approved by the ethics committee of Muhammadiyah University Puwokerto.

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