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Earthworm Extract (Pheretima Javanica K) Against Typhus Disease: Literature Review

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Abstract

This literature review examines the potential use of earthworm extract (Pheretima javanica K) as an alternative treatment for typhus disease. The study analyzes multiple research findings regarding the antibacterial properties of earthworm extracts against Salmonella typhi, the causative agent of typhus. Through a comprehensive review of studies from Web of Science, PubMed, and Google Scholar databases, this research evaluates the effectiveness of different earthworm species and extraction methods. The findings indicate that Pheretima javanica shows promising antimicrobial properties, particularly when extracted with ethanol, while other species such as Lumbricus rubellus demonstrate limited effectiveness. Pheretima javanica shows promise, other species like Lumbricus rubellus demonstrate limited or no significant antibacterial activity against Salmonella typhi. The success of treatment appears to be heavily dependent on factors such as extraction technique, concentration, and testing methodology. Animal studies, particularly those using white rats, have shown encouraging results with specific dosages, but human trials remain necessary to establish clinical efficacy and safety. The varying results across different studies emphasize the need for standardized extraction methods and testing protocols to ensure consistent outcomes.

Keywords: Pheretima javanica, Antibacterial activity, Alternative medicine, Typhus treatment

1. Introduction

Typhus or typhoid fever is an infectious disease caused by the bacteria Salmonella typhi (Siregar et al., 2023). This disease is often a health problem in developing countries, including Indonesia, where environmental factors and inadequate sanitation contribute to the high rate of spread of this disease. Typhus is generally spread through contaminated food or water, and symptoms include high fever, abdominal pain, headaches, and digestive system disorders. In addition, this disease can cause serious complications such as intestinal bleeding and intestinal perforation, especially in cases that are not treated properly (Masuet-Aumatell & Atouguia, (2021).

In modern medical treatment, antibiotics are the mainstay for treating typhoid infections. The use of antibiotics aims to eliminate Salmonella typhi and control the growth of bacteria in the patient's body (Tabassum, 2016). However, in recent years, a serious problem has emerged in the form of antibiotic resistance, where Salmonella typhi is becoming increasingly resistant to various types of antibiotics. This condition not only hinders the effectiveness of treatment, but also has the potential to worsen complications, increase morbidity rates, and cause higher medical costs.

The increasingly widespread antibiotic resistance has prompted scientists and health practitioners to seek alternative solutions in treating typhoid. Natural-based approaches are increasingly being explored as treatment options, given that these natural materials are relatively safe, readily accessible, and often have biological activity that can potentially act as antimicrobial agents. Several studies have shown that bioactive compounds found in certain natural materials can provide antibacterial, anti-inflammatory, and even immunomodulatory effects, helping the body fight infections (Stuper-Szablewska et al., 2022).

Among the many potential natural resources for treatment, earthworms, especially the Pheretima javanica species, are attracting attention as an alternative treatment for infections. Earthworms have been used in traditional medicine to treat a variety of infectious and inflammatory diseases (Waluyo & Wahyuni, 2024). Their use in natural medicine in Asia, especially in countries such as Indonesia and China, has been going on for hundreds of years, with the belief that earthworm extracts can accelerate the healing process and reduce disease symptoms.

The bioactive components in Pheretima javanica earthworms are believed to play a role in their therapeutic effects. Earthworms contain compounds such as lumbrofebrin, lumbricin, and proteolytic enzymes that are thought to have strong antibacterial properties. Several studies indicate that this compound is able to inhibit the growth of pathogenic bacteria, including gram-negative bacteria such as Salmonella typhi (Irwan et al., 2024). In addition, the anti-inflammatory and immunomodulatory content in earthworms allows the body to respond to infections more effectively, which is an advantage in the treatment of typhus.

Research on the use of earthworms as antimicrobial agents is still in its early stages, but early results show promising potential. Several laboratory studies have shown that earthworm extract can inhibit bacterial growth in culture media and increase immunity in infected test animals. However, the use of earthworms to treat typhus has not been widely tested in humans, so further studies are needed to ensure the effectiveness and safety of its use in human patients.

The main objective of this study is to review the potential use of earthworm extract Pheretima javanica as an alternative or additional therapy in the treatment of typhus. By conducting a literature review, it is hoped that a comprehensive picture can be obtained of the effectiveness and mechanism of action of earthworm extract against Salmonella typhi infection. In addition, this study will discuss the safety of using this extract and identify possible side effects and risks that may arise, so that more accurate recommendations can be provided.

2. Literature Review

Table 1: Summary of Research Studies on Earthworm Extract Effectiveness Against Typhus Disease (2012-2023)

No	Author (Year)	Method	Results
A	Syamsuri & Hasanatuludhhiyah, (2023)	In this study, a literature review method was used. The process of data collection involved sourcing articles from three databases, namely Web of Science, PubMed, and Google Scholar. The search utilized the keywords "extract," "medication," and "earthworms."	The results from several collected articles indicate that the benefits and efficacy of earthworm extract involve its role as an antidiabetic agent and in the treatment of ischemic stroke. For typhoid fever, the use of earthworm extract is possible, but it depends on the method of earthworm extraction used.
B	Wahyuni et al., (2021).	Blood extraction for eosinophil and IgE levels and histopathological analysis of kidney and liver tissue.	Pheretima javanica K.butir ethanol extract (PJEEG) has antimicrobial properties and can help treat typhoid fever. This study showed that PJEEG significantly increased eosinophil levels without causing allergic symptoms or toxicity, indicating its potential as a safe traditional medicine.
C	Rochmanti, Debora & Septianda, (2012).	True experimental design with Separate Sample Post-Test Control Group and Earthworm extraction using ethanol for active ingredients.	This study showed that earthworm (Lumbricus sp.) extract did not show antibacterial activity against Salmonella typhii, even at concentrations up to 3200 mg/mL, indicating limited efficacy for treating typhoid. Further studies are recommended.
D	Nurkhasanah, Hapsari & Eurika, (2017).	The research method by conducting research in an experimental laboratory used with Completely Randomized Design (CRD) applied for analysis.	Research shows that earthworm extract (Pheretima javanica K) can inhibit the growth of Salmonella thyposa, the bacteria responsible for typhoid, although its effectiveness is less than optimal compared to turmeric extract at a concentration of 40%.
E	Waluyo, Wahyuni & Utami, (2019).	This research used male white rats (Rattus norvegicus L.) with negative control and positive control using cloramphenicol. and 4 treatment groups of each 5 rats. The test consists of Widal test, feces test and body weight measurement were analyzed descriptively, while body temperature measurement was analyzed by using ANOVA test and continued with Duncan test with confidence rate at 95%	The analyzed results got probably result $p = 0.0001$ ($p < 0.05$) meaning that fresh earthworm has a significant effect on the reduction of typhoid fever in male white rats with optimal dosage is 3 grams / 0.2 kg BW.
F	Nabani et al., (2022)	This study is a type of experimental research using the Disc Difussion method to see how effective the Earthworm extract (Lumbricus Rubellus) is on the growth of Salmonella typhi.	Earthworm extract (Lumbricus rubellus) has not been able to inhibit the growth of Salmonella typhi bacteria, the procedure has been carried out according to optimal standards, but this is influenced by various factors that can affect the results of the inhibition zone from this study, these factors can come from the medium, test bacteria, and during the treatment process.

3. Methodology

The methodology of this literature review includes the collection and analysis of scientific articles on the use of earthworm extracts (Pheretima javanica and Lumbricus rubellus) in the treatment of typhus. Articles were searched through the Web of Science, PubMed, and Google Scholar databases with the keywords "extract," "medication," "earthworm," "Pheretima javanica," "Lumbricus rubellus," and "typhoid fever." Selection was based on inclusion criteria, namely studies using experimental or in vitro methods and studies examining the antibacterial activity of earthworm extracts against Salmonella typhi, the bacteria that causes typhus. Articles that met these criteria were analyzed with a focus on the study design, extraction techniques, and antibacterial test methods used. Important information from each study was compiled in a table for easier comparison and to identify the potential of earthworm extracts as an alternative therapy in the treatment of typhus.

4. Results and Discussion

4.1. Results

Research on earthworm extracts as antibacterial agents in the treatment of typhoid has shown mixed results depending on the extraction method, the species of earthworm used, and the antibacterial testing method applied. The results of various studies in this literature review provide information on the potential of earthworm extracts Pheretima javanica and Lumbricus rubellus as alternatives or additions in the treatment of typhoid. The following is a discussion of the results of several major studies that are the focus of this study.

a). Antibacterial Activity and Antimicrobial Properties of Earthworm Extract
A study by Wahyuni et al. (2021) found that ethanol extract of earthworm Pheretima javanica has significant antimicrobial properties, which help in inhibiting the growth of bacteria that cause typhoid. This study used an animal model, where eosinophil and IgE levels were measured to determine the body's response to the extract. The results of this study indicate that Pheretima javanica extract can increase eosinophil levels without triggering allergic symptoms, thus confirming the safety and potential of this extract as an effective traditional medicine.

b). Effectiveness of Earthworm Extract in Inhibiting Salmonella typhi
Research by Nurkhasanah et al. (2017) showed that Pheretima javanica extract was able to inhibit the growth of Salmonella thyposa bacteria, although its effectiveness was found to be lower than turmeric extract at a concentration of 40%. This study used a Completely Randomized Design (CRD) design to test the effectiveness of various extract concentrations in inhibiting Salmonella. These findings indicate that earthworm extract has antibacterial properties, but further testing is still needed to determine the optimal concentration that is most effective in suppressing the growth of bacteria that cause typhus.

c). Experiments on Test Animal Models and Analysis of Therapeutic Effectiveness
Research by Waluyo et al. (2019) focused on the use of fresh earthworm extract (Pheretima javanica) as a treatment for typhus in white rats (Rattus norvegicus L.). This study showed that earthworm extract at a dose of 3 grams per 0.2 kg of rat body weight had a significant effect in reducing typhus fever. The use of this extract was compared with the positive control chloramphenicol, and the results of the ANOVA statistical test showed that the difference between the treatment groups was significant with a p value <0.05. These results support the use of earthworm extract as an effective therapy for typhus.

d). Limited Effectiveness of Other Earthworm Extracts
In contrast, a study by Rochmanti et al. (2012) using ethanol extract of Lumbricus sp. showed that this earthworm extract did not have significant antibacterial activity against Salmonella typhii even at high concentrations of up to 3200 mg/mL. This study suggests that although some earthworm species may be effective, there is variation in antibacterial effectiveness between species depending on the active chemical composition of each species and the extraction method.

e). Disk Diffusion Method for Testing Earthworm Extracts
A study by Nabani et al. (2022) using the Disk Diffusion method showed that the earthworm extract Lumbricus rubellus did not show a significant inhibition zone against Salmonella typhi. Although the testing procedure has been carried out according to standards, these unsatisfactory results can be influenced by various factors such as the type of media, the condition of the test bacteria, and the extraction method used. This shows that the method and conditions of the test are very important in determining the effectiveness of earthworm extract as an antibacterial agent.

4.2. Discussion

Overall, this review shows that earthworm extract has potential as an antibacterial agent that can be used for the treatment of typhoid, although its effectiveness varies depending on the worm species, extraction method, and type of test. The Pheretima javanica species showed greater potential in the treatment of typhoid than Lumbricus rubellus,

especially when extracted with ethanol. However, different results in other species indicate that not all types of earthworms have the same antibacterial effectiveness, and some of them do not even show activity against Salmonella typhi.

Another factor to consider is the difference in testing methods, such as the use of the Disk Diffusion method which tends to produce negative results in some studies. In addition, other variables such as the type of test medium, extraction technique, and dose and concentration of the extract also greatly affect effectiveness. Experimental studies on animals have shown great potential for earthworm extract to reduce typhoid symptoms and lower body temperature, but its application in humans still requires further research to ensure its safety and effectiveness in certain doses.

5. Conclusion

Pheretima javanica shows promise, other species like Lumbricus rubellus demonstrate limited or no significant antibacterial activity against Salmonella typhi. The success of treatment appears to be heavily dependent on factors such as extraction technique, concentration, and testing methodology. Animal studies, particularly those using white rats, have shown encouraging results with specific dosages, but human trials remain necessary to establish clinical efficacy and safety. The varying results across different studies emphasize the need for standardized extraction methods and testing protocols to ensure consistent outcomes.

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