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Comparison of Skin Swab and Skin Scraping Techniques For Scabies Diagnosis: An Effectiveness Study

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ABSTRAK

Skabies adalah penyakit kulit yang disebabkan oleh infestasi tungau Sarcoptes scabiei var. hominis. Penyakit ini sering menyerupai penyakit kulit lainnya sehingga disebut sebagai The great imitator. Dikenal ada 4 tanda utama (cardinal sign) pada infestasi skabies yaitu adanya gatal hebat pada malam hari (pruritus nocturna), menyerang manusia secara kelompok, terowongan yang ditemukan papul atau vesikel dan menemukan tungau parasit pada luka penderita. Skabies atipik mempunyai beberapa bentuk yang jarang ditemukan dan sulit dikenal, sehingga dapat menimbulkan kesalahan diagnosis. Diagnosis yang akurat sangat penting untuk mencegah penyebaran dan komplikasi lebih lanjut. Beberapa metode pemeriksaan dapat digunakan untuk penegakan diagnosis penyakit ini. Dua metode diagnosis yang dapat digunakan diantaranya adalah teknik swab kulit dan kerokan kulit, namun perbandingan efektivitas keduanya belum pernah diteliti. Penelitian ini bertujuan untuk membandingkan efektivitas kedua teknik tersebut dalam mendeteksi skabies. Desain penelitian ini adalah observasi dengan pendekatan cross-sectional, melibatkan kelinci skabies yang diambil dari Laboratorium Riset Fakultas Kedoteran Universitas Jenderal Soedirman. Sampel yang diambil berjumlah 8 sampel, empat sampel dengan teknik swab kulit dan 4 sampel dengan teknik kerokan kulit. Sampel diambil dari area lesi aktif menggunakan teknik sawab kulit dengan plester transparan dan kerokan kulit menggunakan skalpel steril. Sampel yang diperoleh diperiksa menggunakan mikroskop untuk mendeteksi keberadaan tungau, telur, atau kotorannya. Hasil menunjukkan bahwa tidak ada perbedaan signifikan antara kedua metode (p = 0,448), dengan interval kepercayaan 95%. Meskipun kedua teknik sama-sama efektif, teknik swab kulit menunjukkan keunggulan dalam hal kenyamanan dan kepraktisan. Temuan ini memberikan panduan bagi praktisi medis dalam memilih metode diagnosis yang optimal.

ABSTRACT

Scabies is a skin disease caused by the infestation of the mite *Sarcoptes scabiei* var. *hominis*. This disease often resembles other skin diseases, which is why it is called the great imitator. There are four main signs (cardinal signs) known in scabies infestation, namely severe itching at night (pruritus nocturna), affecting humans in groups, tunnels found with papules or vesicles, and finding parasitic mites in the lesions of the sufferer. Atypical scabies has several forms that are rarely found and difficult to recognize, which can lead to misdiagnosis. An accurate diagnosis is crucial to prevent further spread and complications. Several examination methods can be used to establish the diagnosis of this disease. Two diagnostic methods that can be used include skin swab technique and skin scraping, but the comparison of their effectiveness has never been studied. This study aims to compare the effectiveness of both techniques in detecting scabies. The design of this study is observational with a cross-sectional approach, involving scabies rabbits taken from the Research Laboratory of the Faculty of Medicine at Jenderal Soedirman University. The samples taken amounted to 8 samples, four samples using the skin swab technique and 4 samples using the skin scraping technique. Samples were taken from the area of active lesions using the skin swab technique with transparent plaster and skin scraping using a sterile scalpel. The obtained samples were examined using a microscope to detect the presence of mites, eggs, or their feces. The results show that there is

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no significant difference between the two methods (p = 0.448), with a 95% confidence interval. Although both techniques are equally effective, the skin swab technique shows an advantage in terms of comfort and practicality. These findings provide guidance for medical practitioners in selecting the optimal diagnostic method.

1. INTRODUCTION

Scabies is a skin disease caused by the infestation of the mite *Sarcoptes scabiei* var. *hominis*. *Sarcoptes scabiei* is an ectoparasitic organism from the phylum Arthropoda because it has segmented or jointed legs. This organism is related to spiders and ticks. The name *sarcoptes* comes from the Greek word sark, meaning "flesh," and koptein, meaning "to cut," while *scabiei* comes from the Latin word scabere, meaning "to scratch," which indicates the clinical symptoms of scabies infection (Gandahusada *et al.*, 1998). The *S. scabiei* mite is an obligate ectoparasitic organism that must live in the host's skin layer to survive. *Sarcoptes scabiei* undergoes 4 stages in its life cycle, namely egg, larva, nymph, and adult stage. The fertilized female *Sarcoptes scabiei* will search for the right location on the skin surface to then form tunnels at a speed of 0.5 mm-5 mm per day. The tunnels in the skin can reach the boundary between the stratum corneum and the stratum granulosum. Inside this tunnel, the female mite will live for its entire life, which is approximately 30 days, and lay 2-3 eggs per day. After the eggs hatch, the larvae migrate to the skin surface and hide within the stratum corneum layer to build nests and consume hair follicles, causing hair loss in the infected area. The larvae take 3 to 4 days to molt and then become nymphs. Larvae and nymphs can often be found in hair follicles or hair sacs. The time required from egg to adult form is about 10-14 days. Male mites have a shorter lifespan than female mites and play a minor role in the pathogenesis of the disease. Male *Sarcoptes scabiei* usually die after copulation, but sometimes they can survive for a few days. Gravid female *S. scabiei* mites search for a place to lay their eggs in the skin layer (stratum corneum) by creating tunnels while laying eggs (Ihtiaringtyas *et al*., 2019).

Scabies is generally characterized by intense itching, especially at night, and can spread through direct contact between individuals. Scabies often resembles other skin conditions, which is why it is frequently referred to as "The Great Imitator." The diversity of symptoms that appear in patients, both in the form of classic and atypical lesions, complicates the diagnostic process. There are four main signs (cardinal signs) known in scabies infestation, namely severe itching at night (nocturnal pruritus), occurrence in human groups, tunnels found in the form of papules or vesicles, and the presence of parasitic mites in the infected lesions. These varied symptoms often cause difficulties in clinical diagnosis, especially in atypical cases of scabies that are rarely encountered. This can lead to misdiagnosis or improper management. Therefore, accurate and timely diagnosis is crucial in preventing the spread of disease and reducing the risk of further complications (Musni *et al.*, 2022). With the advancement of technology in the field of health, particularly in the diagnosis of scabies, examinations are conducted to detect the presence of the *S. scabiei* mite in the skin layer. Diagnostic methods that can be used include the burrow ink test, microscopy, dermoscopy, and PCR (Lestari in Hermawan *et al*., 2023).

The use of effective diagnostic methods is a key step in the process of scabies detection. Several skin examination techniques that can be used for scabies diagnosis include skin scraping and skin swab techniques. The skin scraping technique is a method that is often used due to its ease, being a practical and effective skin scraping examination. This method is performed by taking a sample from the infected skin using a scalpel to lift the roof of the papule or canaliculus. However, this technique can cause pain and wounds to the patient and requires certain skills to ensure valid results (Hermawan *et al*., 2023). The skin swab technique is relatively new, using transparent plaster to collect parasite samples from infected skin. Based on the research conducted by Ihtiaringtyas *et al*. (2019), this technique is effective in detecting scabies mites in skin samples from pesantren students, making it effective for diagnosing scabies. Although considered more comfortable and low-risk, the comparison of effectiveness between these two techniques has never been studied, making it an important topic for further research in the

context of scabies diagnosis. Although various scabies diagnosis methods have been developed, the challenge of determining the most effective and comfortable technique for patients remains. Previous research has shown that both skin scraping and skin swab techniques can be used to diagnose scabies, but the comparison of effectiveness between these two methods has not been thoroughly investigated. Therefore, this study aims to compare the effectiveness of skin swab and skin scraping techniques in detecting *S. scabiei* infection in scabies lesions. The results of this study are expected to fill this gap by providing a systematic comparative analysis of these two techniques, thereby offering clearer guidance for medical practitioners in selecting the most appropriate diagnostic method. The clinical relevance of these findings is very important, as the results of this study are expected to serve as a guide for clinicians in choosing methods that are not only accurate but also comfortable for patients. By considering patient comfort and diagnostic accuracy, this research has the potential to improve the quality of care and clinical outcomes for scabies sufferers.

After understanding the challenges in diagnosing scabies, it is important to explore methods that can enhance accuracy and comfort in the diagnostic process. Two techniques that can be used in the diagnosis of scabies are skin scraping and skin swab, each with its own advantages and disadvantages. Therefore, this study aims to compare the effectiveness between the skin swab technique and the skin scraping technique in detecting *S. scabiei* infection in scabies lesions. Using an animal model, this study is expected to provide further insights into the effectiveness of both techniques in diagnosing scabies. This research was conducted on animal subjects, so the results may not be fully generalizable to humans. Therefore, further research with human samples and broader testing is still necessary to strengthen the results of this study.

2. METHOD

The design of this research is an observational study using a cross-sectional technique with a full sampling approach. The test animals in this study were rabbits suffering from scabies. The purpose of this study is to compare the effectiveness of the swab method based on research previously conducted by Ihtiaringtyas *et al*. (2019) with the skin scraping method, which is the simplest and most commonly used method for diagnosing scabies.

Tools and Materials

The materials and tools used in the research include scabies rabbits, ether, 70% alcohol, sterile cotton, cotton buds, glass slides, label paper, clear tape, scalpel, and microscope. The scabies rabbits used in this study were obtained from the Research Laboratory of the Faculty of Medicine, Jenderal Soedirman University. The selection criteria include rabbits that show active scabies lesions so the samples can represent the condition being studied. Although rabbits are not a direct model for humans, they have similar skin structures and are susceptible to *S. scabiei* infections, which allows this research to provide initial insights that can be applied to human diagnosis. However, further studies on human subjects are necessary to ensure the relevance of these results.

Sampling Methods

1. Examination using the skin scraping technique

a. Make sure the rabbit is calm to reduce stress.
b. Identify the area of skin suspected to be infected with scabies, marked by lesions, redness, crusts, or itching.
c. Clean the area of skin that will be scraped with a cotton ball or sterile gauze soaked in 70% alcohol.
d. Apply mineral oil to the skin area to facilitate scraping and prevent tissue damage.
e. Using a sterile scalpel or metal spatula, lightly scrape the affected skin until it bleeds slightly. This ensures that the sample collection reaches the layer where the mites are located.
f. Collect the skin scraping results on the object glass that has been labeled with identity.

g. Add a drop of mineral oil or 10% KOH solution to the sample on the glass slide.
h. Cover the sample with a cover glass.
i. Check under a microscope with low to medium magnification to identify scabies mites.
j. A positive result is indicated by the presence of eggs, larvae, nymphs, or imagos of *S. scabiei.*

2. Examination using the skin swab technique

Based on the method used in the study by Ihtiaringtyas *et al*. (2019), the procedure for scabies examination using the swab technique can be carried out with the following steps.

a. Ensure the rabbit is calm to reduce stress.
b. Identify the area of skin suspected to be infected with scabies, marked by lesions, redness, crusts, or itching.
c. Clean the area of skin to be examined with a cotton ball or sterile gauze soaked in 70% alcohol.
d. Apply ether to the area of skin that will be examined.
e. Attach the clear tape to the area, press it evenly across the entire surface of the tape, then pull the tape off quickly and firmly.
f. Stick clear tape to the glass object that has already been wired.
g. Check under a microscope with low to medium magnification to identify scabies mites.
h. A positive result is indicated by the presence of eggs, larvae, nymphs, or imago of *S. scabiei*.

Data Analysis

Data analysis was conducted using an independent t-test to compare the average effectiveness of two diagnostic techniques (skin swab and skin scraping) on different samples. The independent t-test was chosen because the samples used are independent of each other. Alternative tests, such as the paired t-test, are not considered because the sampling method involves different groups for each diagnostic technique. The independent t-test provides a strong comparison between the two methods without the confounding effects of paired observations.

Limitations

Several limitations were identified in this study. One potential bias is the severity level of skin lesions, which can affect the accuracy of the diagnosis. More severe lesions may yield different results depending on the technique used, which can affect the effectiveness of each method. Additionally, the small sample size may limit the generalization of the findings. Further research is recommended to involve a larger and more diverse sample to validate these results and explore the impact of lesion severity on diagnostic outcomes.

3. RESULT AND DISCUSSION

The results of this study indicate that both the skin scraping technique and the skin swab technique have equivalent effectiveness in diagnosing scabies in rabbits, as shown in Figure 1. The skin scraping technique, which involves taking the epidermal layer until reaching the dermal layer where the mites live, has proven to have high sensitivity in detecting the presence of *S. scabiei*. This process involves the use of a scalpel to lift the roof of papules or canaliculi, allowing for direct identification of the mites and their eggs. Although this technique is often considered the standard method in scabies diagnosis, the procedure can cause discomfort and pain to the patient, and it requires special skills to ensure valid and accurate results. On the other hand, the skin swab technique, which is relatively new and less invasive, also demonstrates consistent ability in detecting mites. This method uses a transparent plaster to collect samples from the infected skin, thereby reducing the risk of tissue trauma and increasing patient comfort. Previous research has shown that the skin swab technique can be an effective alternative, especially in contexts where patient comfort is a priority. Both techniques qualify as valid diagnostic methods for scabies, as stated by Bowman (2014) and Wlaton and Currie

(2007), who emphasize the importance of using diagnostic methods that are not only accurate but also practical in clinical applications. Considering the results of this study, it can be concluded that both the skin scraping technique and the skin swab can be effectively used in the diagnosis of scabies, providing options for medical practitioners to choose the method that best suits the patient's needs and clinical context.

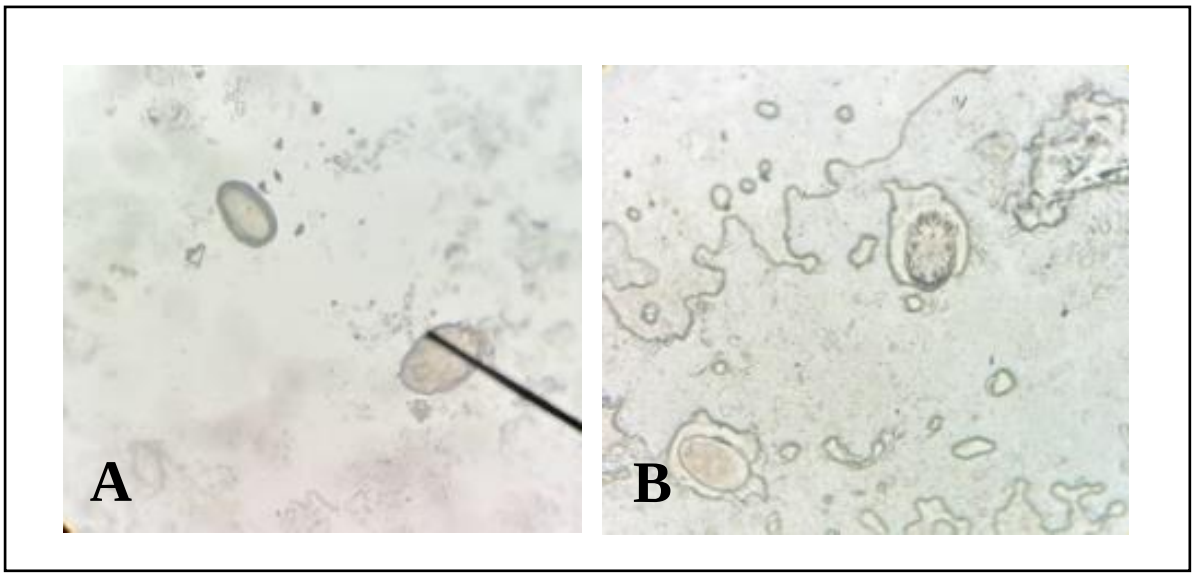

Figure 1. Microscopic examination of the *S. scabiei* parasite, skin scraping technique (A) and skin swab technique (B)

Based on the research conducted, the number of *S. scabiei* parasites found using each examination technique, both the skin swab technique and the skin scraping technique, is presented in Figure 2 below.

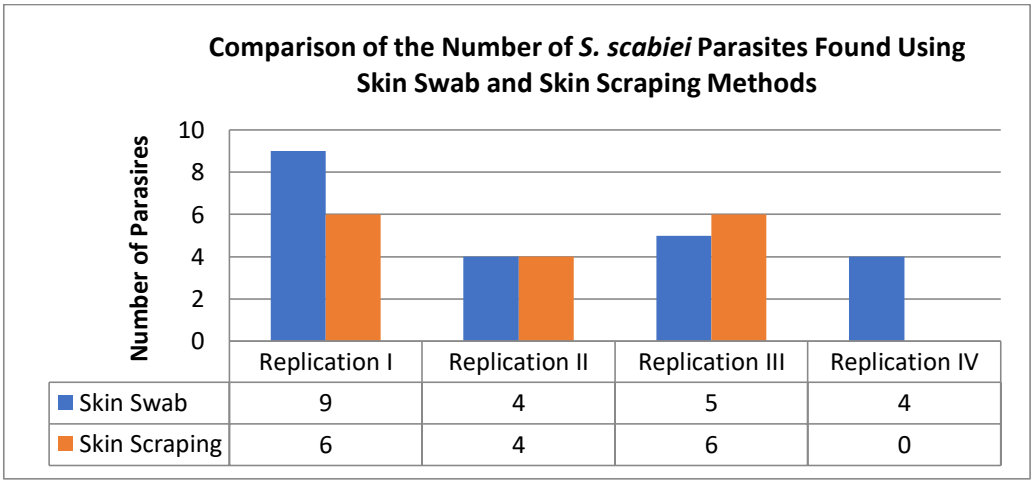

Figure 2. Comparison of the Number of *S. scabiei* Parasites Found Using Skin Swab and Skin Scraping Methods

Based on Figure 2, the results of the parasites found in each repetition using the skin swab and skin scraping methods both yielded positive results for the presence of the *S. scabiei* parasite. From the 4 replications, the skin swab method detected more parasites compared to the skin scraping method, with an average of 5.5 parasites for the skin swab and 4.0 for the skin scraping. Nevertheless, this difference is not significant enough to conclude that one method is more effective than the other. Next, a normality test was conducted on each method to determine whether the data is normally distributed, as shown in Table 1 below.

Table 1. Normality Test with Shapiro-Wilk for Skin Swab and Skin Scraping Methods

Methods	Statistik Shapiro-Wilk	P Value	Result
Swab	0,763	0,051	Data approaches normality (p > 0,05)
Scraping	0,827	0,161	Data is normally distributed (p > 0,05)

In Table 1, both data are normally distributed (p > 0.05), and comparisons can be made using parametric tests such as the independent t-test. The results of the independent t-test to compare the skin swab method and skin scraping method can be seen in the following Table 2.

Table 2. Results of the paired t-test comparing the skin swab method and skin scraping method

Statistic Test	t-test	P Value	Result
Independent t-test	0,812	0,448	there is no significant difference (p > 0,05)

Based on Table 2, no statistically significant difference was found between the results obtained from the skin swab method and the skin scraping method, with a p-value of 0.448 (p > 0.05), with a 95% confidence interval. This indicates that in the context of the analyzed data, both methods yield comparable results. In other words, the skin swab and skin scraping methods can be considered to have a similar level of effectiveness in detecting the examined condition. Therefore, both methods can be used for the diagnosis of scabies, depending on preferences, needs, or specific clinical situations.

Animal comfort during the procedure is also one of the important considerations in this research. The skin swab technique, which is less invasive compared to skin scraping, is considered more comfortable for rabbits, as evidenced by the animals' behavior during the examination. The reduction of stress in animals during diagnosis has a positive impact on the comfort of the animals during the examination, according to Ristic and Barutzki (2017). Although the skin scraping technique yields equally effective results, its use potentially increases the risk of irritation or minor trauma to the rabbit's skin, especially in areas with pre-existing lesions.

In terms of practicality, the skin swab technique also has advantages in terms of preparation and execution. The use of clear tape facilitates sample collection without the need for additional tools such as scalpels. This is in line with previous research conducted by Ihtiaringtyas et *al*. (2019), which stated that the swab technique is effective in diagnosing scabies in students at Pondok Pesantren An Nawawi Berjan, Purworejo, Central Java. In that study, the students were examined using the swab method to detect the presence of the *S. scbiei* parasite. The research results show that the swab method is effective for diagnosing scabies. Out of 161 students examined, 115 students tested positive for scabies with the *S. scabiei* parasite found in the samples examined. On the other hand, the skin scraping technique requires more invasive tools and takes longer to sterilize the instruments before and after the procedure. This was stated in the research by Permana et al. (2020) and Arlian and Morgan (2017), which indicated that simple and practical diagnostic procedures are preferred in routine examinations for the diagnosis of scabies.

This comparison also shows that the effectiveness of diagnosis alone is not sufficient as the main criterion in choosing the examination method. Factors such as patient comfort, practicality, and potential complications become important aspects that must be considered in clinical decision-making. From a clinical perspective, the results of this study have important implications, especially for human patients. Although this study was conducted on rabbits, the relevance of the results can be applied to the diagnosis of scabies in humans. The skin swab method, which is less invasive, can reduce discomfort and stress in patients, which are important factors in clinical practice. By considering patient comfort, this method can improve patient compliance with diagnostic and treatment procedures, as well as enhance the relationship between practitioners and patients. As explained by Traversa et al. (2019), patient-friendly diagnostic methods not only improve clinical accuracy but also enhance the relationship

between practitioners and patients. Therefore, the skin swab method can be considered a superior alternative in clinical practice, despite having the same effectiveness as the skin scraping technique. The skin swab method offers several practical advantages in real-world settings. First, this technique is simpler and faster compared to skin scraping, which requires additional tools and longer sterilization time. The use of clear tape in sample collection allows for a cleaner and more efficient procedure, without the risk of additional irritation to already irritated skin. Additionally, the comfort of the animals during the procedure, which is also relevant for human patients, indicates that the swab method can reduce the risk of minor skin trauma, making it safer to use, especially on sensitive lesion areas (Susiawan et al., 2024).

Overall, both techniques, skin swab and skin scraping, have proven effective for scabies diagnosis, but the skin swab technique is superior in terms of comfort and practicality, as well as the importance of a diagnostic approach that not only focuses on results but also considers the well-being of the patient and ease of implementation. The results of this study are expected to serve as a guide for clinicians in selecting the most appropriate method for diagnosing scabies. Further research on human subjects is needed to confirm these findings and to explore in greater depth the potential clinical applications of this method.

4. CONCLUSION

The conclusion of this study is that both skin swab and skin scraping techniques are equally effective in diagnosing scabies in rabbits, with the skin swab technique showing superiority in terms of comfort and practicality. The results of this study provide scientific evidence that the skin swab technique can be an alternative method for diagnosing scabies that is more comfortable for patients without sacrificing accuracy. The development of this technique also allows for the use of additional tools to enhance diagnostic sensitivity in mild or difficult-to-detect scabies cases. Further research is recommended to explore the effectiveness of these two techniques on larger samples, different severity levels of scabies, and cost-benefit analysis for broader clinical application.

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