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Education and Workshop Improve Healthcare Workers' Knowledge of Laboratory Examination for the Diagnosis of Superficial Dermatomycosis

Evy Ervianti, Linda Astari, Rahmadewi, Trisniartami Setyaningrum, Hasnikmah Mappamasing, Sylvia Anggraeni, Yuri Widia, Diah Ngesti Kumalasari, Presstisa Gifta Axelia, Farsha Naufal Hadiwidjaja, Olivia Awwalin Sunarto, Kathrin Kezia Henry, Sulaksanaswastho Suyoso, Erindah Puspowati

Departement of Dermatology and Venereology, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Universitas Airlangga, Surabaya - Indonesia

ABSTRACT

Background: Superficial dermatomycosis is one of the most prevalent skin diseases worldwide. The diagnosis of superficial dermatomycosis is established clinically, and supported by several examinations, such as microscopic examination, fungal culture, and Wood's lamp examination for certain species. **Purpose**: This study is to evaluate the improvement of the knowledge of general practitioners and medical analysts after education and workshop. **Methods**: This cross-sectional observational study involved 70 subjects, consisting of 35 general practitioners and 35 medical analysts from 35 public health centers in Bojonegoro who were willing to participate in this study. The level of knowledge was assessed before and after the health education on laboratory examination for the diagnosis of superficial dermatomycosis. **Result**: There was a significant difference in mean scores between the pre-test and post-test after health education (p = <0.001). The mean knowledge score of the pre-test before intervention among general practitioners was 36.57 ± 19.088, which increased to 68.00 ± 13.240, and the mean knowledge score before intervention among analysts was 27.14 ± 13.842, which increased to 62.00 ± 12.078 after health education intervention. **Conclusion**: Following health education, there was an improvement in the healthcare workers's knowledge of laboratory examinations for the diagnosis of superficial dermatomycosis.

Keywords: tropical diseases, superficial dermatomycosis, laboratory examination, health education, public health.

Correspondence: Evy Ervianti, Department of Dermatology and Venerology Faculty of Medicine, Universitas Airlangga / Dr. Soetomo General Academic Hospital, Surabaya, Jl. Mayjen Prof. Dr. Moestopo No. 6 - 8 Surabaya 60131, Indonesia. Phone: (031) 5501609, e - mail: evy-e@fkg.unair.ac.id

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BACKGROUND

Superficial dermatomycosis is one of the most prevalent skin diseases worldwide. This infection is caused by several types of fungi that are capable of infecting different parts of the human body. The cause of this disease mostly grows in warm and humid environments.[1] An increase in the prevalence of superficial dermatomycosis has been observed in recent years worldwide, especially in tropical regions.[2] The diagnosis of superficial dermatomycosis is established clinically and supported by several examinations, such as microscopic examination, fungal culture, and Wood's lamp examination for certain species. Culture examination aims to identify fungal species. The potassium hydroxide (KOH) 10-20% examination aims to find hyphae or spores.[3] The guidelines recommend establishing the diagnosis of superficial dermatomycosis by examining direct preparations of skin or nail scrapings using a microscope and 10-20% potassium hydroxide.[4]

Potassium hydroxide examination of dermatophytosis shows hyphae to be septated and branched.[5] Potassium hydroxide and Gram examination of candidiasis showed oval-shaped budding yeasts, and pseudohyphae. A potassium hydroxide examination of pityriasis versicolor showed clustered spores and short hyphae.[4] The adequacy of the sample, the appropriateness of the tools used for sample collection, and the expertise of the health

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workers determine the sensitivity and specificity of the diagnosis of superficial dermatomycosis.[1]

The purpose of this study is to evaluate the improvement of the knowledge and abilities of general practitioners and medical analysts after a health education and workshop so that diagnosis can be established faster and patients reveive the right therapy.

METHODS

This was cross-sectional observational study involving 70 subjects, consisting of 35 general practitioners and 35 medical analysts from 35 public health centers in Bojonegoro, East Java, Indonesia. The data was collected using Google form questionnaires. Then the data was analyzed with paired T-test using the SPSS (Statistical Program for Social Science) program. The inclusion criteria for this study were general practitioners and medical analysts from 35 public health centers in Bojonegoro. The sampling technique used in this study was consecutive sampling. Subjects who were willing to participate in this study were asked to fill in 10 questions on pre-test questionnaires about laboratory examinations for the diagnosis superficial dermatomycosis. The assessment method is based on the results of distributing pre- and post-questionnaires to general practitioners and medical analysts. There are two types of questionnaires; each questionnaire is given at the time of pre- and post-test. The first questionnaire was given during the implementation of community service (day 1), and the second questionnaire was conducted during monitoring and evaluation (day 30). After all subjects filled in the questions on the pre-test, health education was performed through lectures, discussions, workshops, the distribution of booklets, and educational videos. The health education method on day 1 is carried out offline by gathering all participants in one room and getting all types of education and potassium hydroxide (KOH) examination workshop. On day 30, participants were asked to practice on patients in the public health center. The results of the examination are presented and discussed during monitoring and evaluation, and educational material is repeated. After health education was presented, participants were asked to fill out questions on the post-test. Pre- and post-tests are carried out offline and online. The results of the pre-test and post-test were analyzed as data that would present the level of knowledge of the subjects.

RESULT

This study involved 70 subjects, consisting of 35 general practitioners and 35 medical analysts from 35 public health centers in Bojonegoro. Demographic data of research subjects in the form of gender, age and occupation are described in Table 1.

Table 1. Subjects characteristics

Category	Sub Categories	Frequency (n)	Percentage (%)
Age Group	≤29 years	21	28.0%
	30-39	32	42.7%
	40-49	16	21.3%
	50-59	6	8.0%
	≥ 60 years	0	0%
	Total	70	100%
Gender	Female	53	24.3%
	Male	17	75.7%
	Total	70	100%
Profession	General practitioners	35	50%
	Medical Analysts	35	50%
	Total	70	100%

The data normality test was carried out using Shapiro Wilk and obtained $p > 0.05$, which means the data is normally distributed. Based on the results of the *T-test* in Table 2, the mean knowledge score of the pre-test before intervention among general practitioners was 36.57 ± 19.088, which increased to 68.00 ± 13.240 after health education intervention, which was statistically significant at a *paired T-test*, $p<0.0001$. Similarly, the mean knowledge scored before intervention among medical analysts was 27.14 ± 13.842, which increased to 62.00 ± 12.078 after health education intervention, which was statistically significant at *paired T-test* $p<0.0001$ (Table 2). Thirty days after the training, additional evaluations and monitoring are conducted using various pre- and post-test questionnaires to evaluate the general practitioners' and medical analysts' continuous educational improvement. The results of the *T-test* in Table 2 obtained a p-value of 0.000 for each variable ($p<0.05$). This explains that there is also an increase between the pre-test and post-test scores of general practitioners and medical analysts on day 30 of monitoring and evaluation of training.

Table 2. Pre-test and post-test improvement on training, monitoring, and evaluation of implementation

Day		Pre-test		Post-test		P-value
		Mean	SD	Mean	SD	
1	General practitioners	36.57 ± 19.09		68.00 ± 13.24		0.00
	Medical analysts	27.14 ± 13.84		62.00 ± 12.08		
30	General practitioners	39.43 ± 20.86		78.29 ± 15.24		0.00
	Medical analysts	38.29 ± 19.17		75.71 ± 18.99		

*SD: standard deviation

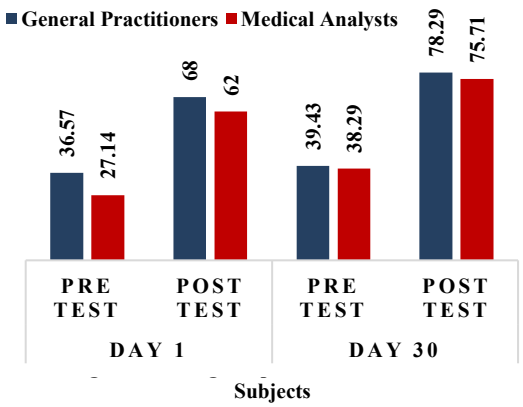

Figure 1. Score of pre-test and post-test.

A significant improvement in knowledge was observed on day 1 of education and workshop implementation and on day 30 during the monitoring of training evaluation. According to the results of the *paired T-test* analysis performed on general practitioners, the p-value for this study was 0.000 ($p<0.05$), which was statistically significant. Table 3 shows that on day 1 of training, general practitioners' knowledge increased by 31.42 points, and on day 30 of the monitoring and training evaluation, their knowledge increased by 38.85 points. The Delta-1 and Delta-2 scores show the variation in knowledge development between the pre-test and post-test results on days 1 and 30. The value of knowledge improvement is known by subtracting the post-test and pre-test values and obtaining a p-value of 0.000 ($p<0.05$), which means statistically significant.

The results of the *paired T-test* analysis conducted on the medical analyst profession also showed the same results as those of general practitioners. The results above show a significant increase in knowledge on day 1 of training implementation and on day 30 during the monitoring of training evaluation, with a p-value of 0.000 ($p<0.05$). Table 4 shows that in the training, there was an increase in medical analyst knowledge on day 1 of 34.85 points, while on the 30th day of monitoring and evaluation of the training, the increase in knowledge was 37.42 points. The Delta-1 and Delta-2 scores show the variation in knowledge development between the pre- and post-test results on days 1 and 30. The value of knowledge improvement is known by subtracting the post-test and pre-test values and obtaining a *p-value* of 0.003 ($p <0.05$), which mean it is statistically significant.

Table 3. Analysis of knowledge improvement in general practitioners

	Result (Mean ± SD)		
	Mean	SD	p-value*
PRE H1 - POST H1	-31.43	17.68	0.00
PRE H30 - POST H30	-38.86	16.41	0.00
DELTA1 - DELTA2	-0.19	0.24	0.00

**Paired T-test*
SD: standard deviation

Table 4. Analysis of knowledge improvement in medical analysts

	Result (Mean ±SD)		
	Mean	SD	p-value*
PRE H1 - POST H1	-34.86	11.97	0.00
PRE H30 - POST H30	-37.43	17.21	0.00
DELTA1 - DELTA2	-0.15	0.29	0.00

*Paired *T-test*
SD: standard deviation

DISCUSSION

Superficial dermatomycosis is a fungal infection of the epidermal layer of the skin, nails, hair, or mucosa caused by the colonization of fungi or yeast. The incidence of superficial dermatomycosis is estimated to be around 20–25% of the world population and is one of the most frequent infections in humans.[6] The increased prevalence of dermatomycosis shown in recent decades is due to the impact of both lifestyle factors and genetic predisposition.[7,8] Despite not being a life-threatening condition, it can have a major impact on the quality of life.[2] Dermatomycosis has been reported to have a 10–20% lifetime risk globally, with foot infections being the most common type. Treatment for dermatomycosis costs $500 million per year globally due to the high infection rate.[9]

Globally, and especially in the tropics, the prevalence of dermatomycosis infections has increased in recent years. Indonesia is a tropical country, warm and humid, with many environmental fungi. The tropical climate, accompanied by high temperatures and humidity, creates a good atmosphere for fungal growth, so it is estimated that the incidence of this disease is quite high in the community.[10] A number of environmental and cultural factors can affect the distribution of superficial dermatomycosis, including geographic location, causative species, and predominant anatomical location patterns.

This is related to Bojonegoro, one of the tropical regions of East Java Province. Based on its topography, Bojonegoro is mostly an agricultural region with a high population density of 3,356 people per km^2. According to data collected from the Bojonegoro Health Profile (2023), it states that there were 4454 (3%) new cases of skin diseases detected at 35 public health centers in Bojonegoro.[11] This explains that, aside from a beneficial tropical climate, other factors like the presence of environmental sources of fungal transmission and a lack of public knowledge regarding sanitation practices may promote fungal penetration and increase the incidence of fungal diseases in Bojonegoro.

The largest percentage of dermatophytosis (52.7%), PV (28.1%), and candidiasis (12.7%) were recorded in Dr. Soetomo General Hospital (RSUD) in 2011. Based on a retrospective study in 2018, it shows that dermatophytosis cases are increasing. According to Rahadiyanti D and Ervianti E (2018), the number of new cases of dermatophytosis in the Dr. Soetomo Surabaya Hospital Mycology Division's Outpatient Clinic has increased over the course of three years, with percentages of 78.3% (2014), 62.2% (2015), and 72.3% (2016).[12]

Based on anamnesis, clinical examination, and laboratory support investigation, superficial dermatomycosis can be diagnosed. Direct microscopic examinations such as potassium hydroxide (KOH) and Gram examinations are useful for rapid detection of dermatophytosis. This procedure is a simple, cheap, fast, and efficient screening method that can be easily performed by health workers.[2] Meanwhile, fungal culture or culture examination can be performed to confirm a specific diagnosis in some circumstances, or research reasons, or for case reports.[13]

Accurate diagnosis is critical for patient management and the implementation of appropriate therapies. Many kinds of dermatomycosis are difficult to distinguish clinically from other skin illnesses due to clinical overlap. Additionally, a large percentage of dermatomycosis cases happen in developing countries where populations are unable to access health care.[14] Misdiagnosis can have serious consequences, especially in immunocompromised patients, as the condition can develop into a deeper invasion, leading to disseminated dermatophytosis and invasive dermatitis. Misdiagnosis can also occur as a result of misidentifying the dermatophyte responsible for the infection.[15]

General practitioners and medical analysts at public health centers have an important role in providing health services to the community. Rapid diagnosis is important to determine initial therapy and avoid delays in patient disease management. Therefore, it is expected that general practitioners and medical analysts can have good knowledge and abilities in implementing the diagnosis of fungal infections through accurate laboratory support examinations. This study is expected to provide insight for general practitioners and medical analysts in all public health centers in Bojonegoro regarding laboratory support examination procedures to help determine a diagnosis of superficial dermatomycosis, as an alternative to direct preparation examinations that are easier to interpret for clinicians and laboratories, while for patients it is expected to establish faster and patients get the right therapy.

The laboratory examination for diagnosis of superficial dermatomycosis workshop was implemented for 75 general practitioners and medical analysts. The highest number of participants (42.7%) belonged to the 30-39 age group, followed by ≤29 (21 individuals, or 28% of the total) and 40-49 (six individuals, or 8.0% of the total). Of the 75 participants in total, 53 (75.7%) were female and 17 (24.3%) were male.

Tables 2 and 3 show an increasing level of knowledge. We can see that there are higher values in Table 4, which shows the results of the pre-test and post-test during monitoring and evaluation, compared to Table 3 which shows the results of the pre-test and post-test on the first day. Participants are able to easily comprehend the material provided through case discussion methods and direct examinations of patients, which leads to improved results when the pre- and post-tests are carried out again during monitoring and evaluation. The 30th day of monitoring and evaluation was completed with an interesting and complete patient case presentation, accompanied by the results of supporting examinations. This shows that participants can carry out appropriate supporting examinations.

In a study by Naila, Retno, and Agus in 2019, it was stated that there was a significant influence of counseling, especially audiovisual media, on increasing participants' knowledge.[16] Apart from that, Imran's 2017 research stated that there was a significant difference in the pre-test and post-test scores on participants' knowledge after being given counseling.[17]

Based on the analysis of the increased knowledge of general practitioners in Table 3, it can be seen that the difference in pre-and post-test results H-1 has a value of -31.429 (p = 0,000) and H-30 has a value

of -38.857 (p = 0,000). It shows that both in the training and monitoring process, there is a significant improvement in the knowledge of the doctor after training. Even in a comparison of Delta 1 and Delta 2, which compared the changes in the doctor's knowledge on the day of training (H-1) and monitoring (H-30), it was found that there was a significant improvement in knowledge on day 30.

The same thing is also obtained in the results of increasing medical analyst knowledge displayed in Table 4. There is an increase in pre-and post-test medical analyst knowledge at H-1 with a value of -34.857 (p = 0.000) and H-30 with a value of -37.429 (p = 0.000), both of which show significant results.The difference in knowledge between H-1 and H-30 is also shown in the difference between Delta-1 and Delta-2, which has a value of -.1549 (p =0.003) which means that there is an increase in knowledge among medical analysts on day 30. This shows that providing training and conducting material exposure and case discussions for general practitioners and medical analysts can improve memory and increase knowledge for participants. The existence of workshops, tutorials, and case discussions with experts is expected to be useful for general practitioners and medical analysts who are at the first level of health facilities in detecting, diagnosing, and carrying out appropriate management of superficial dermatophytosis cases in the community.

For sustainable health services, it is hoped that healthcare workers who have received training can carry out outreach at their respective public health centers regarding knowledge of fungal infections. Apart from that, the availability of equipment such as microscope samples and reagent materials is also very much needed; on average, all public health centers in Bojonegoro already have microscopes. Support from the Bojonegoro District Health Service is essential for better service quality.

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