INDOGENIUS

ISSN 2828-1365

Volume 5, Issue 1 : 20-30

Identification of Fungal Infections on the Fingernails of Warteg Employees in Pekalongan Regency

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Article Info

Keywords :
Dermatophytes, Non-Dermatophytes, Fingernails

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ABSTRACT

Background & Objective: Fungi are one of the microorganisms that cause disease in humans. Fungi are cosmopolitan organisms that grow anywhere, including in the air, soil, water, clothing, and even on the human body itself. Fungi can cause quite severe diseases in humans. Most skin and nail infections are the result of a group of homogeneous keratinophilic fungi known as dermatophytes. Dermatophytosis of the fingernails and toenails, unlike dermatophytosis in other parts of the body, is very difficult to treat with medical treatment. This study aims to determine the presence of Dermatophyta and Non-Dermatophyta fungi on the fingernails of warteg employees in Pekalongan Regency. **Method:** This study is a descriptive study using total sampling with 30 respondents. **Result:** Examination of 30 fingernail samples from food stall employees yielded positive results for Trichopyton sp. dermatophyte fungi in approximately 17% (5 samples), positive results for Candida sp. non-dermatophyte fungi in 87% (26 samples), and positive results for Aspergillus sp. fungi in 60% (18 samples). **Conclusion:** Usually, some warteg sellers are found to lack hygiene in their fingernails while working. Risk factors that can cause fungal infections in fingernails in this study include several habits at work, such as frequent direct contact with water, causing the hands to become moist, not many people wearing gloves while working, and not maintaining fingernail hygiene, such as cutting nails more than once every two weeks.

DOI: https://doi.org/10.56359/igj.v5i1.670
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Introduction

Most skin and nail infections are caused by a group of homogeneous keratinophilic fungi known as dermatophytes. The fungi that cause onychomycosis are usually of the *Trichophyton sp* species (especially *T. rubrum* and *T. mentagrophytes*). Dermatophytosis of the fingernails and toenails, unlike dermatophytosis in other parts of the body, is very difficult to treat with medical treatment (Supenah, 2020).

One of the most common diseases in Indonesia as a tropical country is mycosis, especially superficial mycosis, whether it occurs on the nails (onychomycosis) or on the skin. Personal hygiene and environmental factors are the most significant contributors to the onset of pathogenic infections causing disease in the body (Husen, Khasanah, and Ina Ratnaningtyas, 2024).

In six recently published epidemiological studies, the global prevalence of onychomycosis was estimated at 5.5%, which falls within the range of previously reported estimates (2%-8%). (Husen, Khasanah, and Ina Ratnaningtyas, 2024)

Fungi are one of the microorganisms that cause disease in humans. Fungi are cosmopolitan organisms that grow everywhere, including in the air, soil, water, clothing, and even on the human body itself. Fungi can cause quite severe diseases in humans. (Hasanah, 2017).

Fungal nail infections caused by dermatophyte fungi are termed Tinea unguium. This fungal infection causes changes in nail color, turning them white, yellow, or brownish. The nails may experience onycholysis, become brittle, and uneven. According to experts, onychomycosis does not cause mortality but leads to significant clinical disturbances, reduces aesthetics, is chronic, and is difficult to treat. This further disrupts comfort and lowers the quality of life for the patient. (Setianingsih, Arianti, and Fadilly, 2015).

Once infected, it can affect one nail or even more. The initial appearance of this fungal cause is as a white or yellow spot under the tip of the fingernail or toenail, which eventually infects and can cause this nail disease to appear.

Based on previous research conducted by students of the Denpasar Ministry of Health Polytechnic named Ni Kadek Sintya Mayumi, Nur Habibah, and I N. G. Suyasa in 2023 on "Identification of Fungi Causing Onychomycosis in Chicken Meat Vendors in Traditional Markets" in the village of Batubulan, Denpasar, Bali. The study explained that to identify the fungi causing onychomycosis, data collection was first conducted through interviews, observations, and laboratory examinations to further identify the types of fungi. The identification was then carried out using the SDA (Sabaroud Dextrose Agar) culture method, which was cultivated and incubated for 3-7 days, after which it was observed under a 40x magnification microscope with Lactophenol Cotton Blue (LPCB) staining (Mayumi, Habibah and Suyasa, 2023).

Since there has been no previous research data on the identification of nail fungus in warteg employees, the researchers were interested in conducting research on the identification of nail fungus in warteg employees in Pekalongan Regency using the SDA (Sabaroud Dextrose Agar) culture method. The research was conducted at the Hematology Laboratory of the Pekalongan Health Analyst Academy. The first step was to sterilize the equipment to be used, then prepare SDA (Sabaroud Dextrose Agar) as a culture medium for the fungi to grow. After preparing the medium, culture or planting could be carried out with an incubation period of 3-7 days. Observation was performed using LPCB (Lactophenol Cotton Blue) staining.

Objective

This study aims to determine the presence of non-dermatophyte and dermatophyte fungi in nail samples from warteg employees in Pekalongan Regency.

Method

The type of research used in this study is descriptive research, which is a research method that describes or describes a phenomenon or problem being studied in detail and accurately. This type of research is in line with the research to be conducted, which is to identify dermatophyta and non-dermatophyta fungi on the fingernails of warteg employees in Pekalongan Regency. This research was conducted from February 19 to February 26, 2025. The population in this study consisted of warteg employees in Pekalongan Regency, totaling 30 respondents. The sample used in this study was the entire population, using total sampling technique. Sample examination was carried out at the Hematology Laboratory of the Pekalongan Health Analyst Academy. Data analysis technique: the data obtained from the research results were compiled in tables and analyzed descriptively.

Results

Based on the results of observations of dermatophyte and non-dermatophyte fungi on the fingernails of warteg employees in Pekalongan Regency, conducted on Wednesday, February 19, 2025, and Tuesday, February 26, 2025, at the Pekalongan Health Analyst Academy Clinical Laboratory, using macroscopic and microscopic examinations with cultivation on SDA (*Saboroud Dextrose Agar*) for 3 days at 37^{o}C, the following results were obtained:

TABLE 1. Results of macroscopic observation of dermatophyte and non-dermatophyte fungi on the fingernails of warteg employees in Pekalongan Regency

Fungus	Shape	Color	Type
Tricophyton rubrum	irregular and cotton-like	white	Dermatophytes
Trichopyton mentagrophytes	irregular and cotton-like	yellowish white to white	Dermatophytes
Aspergillus sp	irregular and stringy like cotton	black	Non-dermatophytes
Candida sp	round and slimy	white	Non-dermatophytes
Mucorsp	irregular and cotton-like	gray	Contaminants
Rhizopus sp	irregular	White to orange gradually turning gray	Contaminants

Based on Table 1, the macroscopic examination of fingernail fungi in warteg employees in Pekalongan Regency revealed non-dermatophyte fungi of the *Candida sp.* and *Aspergillus sp.* species. Dermatophyte fungi of the *Tricophyton rubrum* and *Trichophyton mentagrophytes* species were also found. Contaminant fungi *Mucor sp* and *Rhozopus sp* were also observed in the form and color of each fungus.

TABLE 2. Results of microscopic observation of dermatophyte and non-dermatophyte fungi on the fingernails of warteg employees in Pekalongan Regency

Sample Code	Characteristics	Description
S1	There are blastospores and chlamydospores.	*Candida sp*. (Non-dermatophyte)
	There are conidiophores or septate hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp*. (Non-dermatophyte)
S2	There are blastospores and chlamydospores.	*Candida sp.* (Non-dermatophyte)
S3	There are septate and branched conidiophores or hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp*. (Non-dermatophyte)
	There are blastospores and chlamydospores.	*Candida sp*. (Non-dermatophyte)
S4	There are blastospores and chlamydospores.	*Candida sp*. (Non-dermatophyte)
	There are conidiophores or septate and branched hyphae, round vesicles, round conidia, and long sterigmata covered with conidia.	*Aspergillus sp*. (Contaminant)
	There are hyphae, spongiofor, round sporangia, and columella.	*Mucor sp.* (Negative)
S5	There are hyphae, blastospores, and chlamydiospores.	*Candida sp*. (Non-dermatophyte)

Sample Code	Characteristics	Description
S6	There are hyphae, stolons and rhizoids, sporangiospores, and large round columellae.	*Rhizopus sp.* (Negative)
	There are hyphae, spongiofor, round sporangia, and columellae.	*Mucor sp.* (Negative)
S7	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are hyphae, round microconidia like teardrops.	*Trichophyton rubrum* (Dermatophyte)
S8	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
S9	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores or septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
S10	There are conidiophores or septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
	There are hyphae, blastospores, and chlamydospores	*Candida sp* (Non-dermatophyte)
S11	There are blastospores and chlamydospores	*Candida sp* (Non-dermatophyte)
S12	There are blastospores and chlamydospores	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)

Sample Code	Characteristics	Description
S13	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
S14	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
S15	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
	There are hyphae and round microconidia resembling teardrops.	*Trichophyton rubrum* (Dermatophyte)

S16	There are hyphae, blastospores, and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to the conidia.	*Aspergillus sp* (Non-dermatophyte)
S17	There are hyphae, sporangiospores, small round spores in clusters, sporangia enclosing the spores, and a columella.	*Mucor sp.* (Negative)
	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)

Sample Code	Characteristics	Description
S18	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
	There are hyphae, sporangiospores, small round spores in clusters, sporangia enclosing spores, and columellae.	*Mucor sp.* (Negative)
S19	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
S20	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
S21	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
S22	There are sporangiospores, small round spores in clusters, a sporangium enclosing the spores, and a columella.	*Mucor sp.* (Negative)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata covered with conidia.	*Aspergillus sp* (Non-dermatophyte)

Sample Code	Characteristics	Description
S23	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)
S24	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)

	There are hyphae, round microconidia clustered like grapes.	*Trichophyton mentagrophytes* (Dermatophyte)
S25	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are hyphae, round microconidia clustered like grapes, and club-shaped macroconidia.	*Trichophyton mentagrophytes* (Dermatophyte)
S26	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to the conidia.	*Aspergillus sp* (Non-dermatophyte)
S27	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia.	*Aspergillus sp* (Non-dermatophyte)

Sample Code	**Characteristics**	**Description**
S28	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata.	*Aspergillus sp* (Non-dermatophyte)
	There are hyphae, round microconidia resembling teardrops.	*Trichophyton rubrum* (Dermatophyte)
S29	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
S30	There are blastospores and chlamydospores.	*Candida sp* (Non-dermatophyte)
	There are conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata.	*Aspergillus sp* (Non-dermatophyte)

Based on Table 2, the results of microscopic examination of fingernails of warteg employees in Pekalongan Regency from 30 samples showed colonies of Trichophyton mentagrophytes, Trichophyton rubrum, Aspergillus sp, Candida sp, Mucor sp, and Rhizopus sp. Direct observation was conducted based on the characteristics of the fungi found.

The fungi that had grown on the medium were then examined under a microscope at 40x magnification, and their morphology was observed as follows:

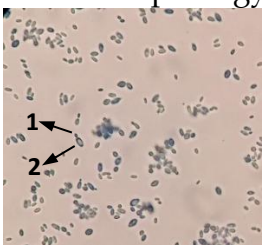

FIGURE 1. *Candida sp.* fungal colony

Image description:
1. Blastospore
2. Chlamydospore

Based on Figure 1, which shows the characteristics of fungi, namely blastospores and chlamydospores, the fungus is *Candida sp*.

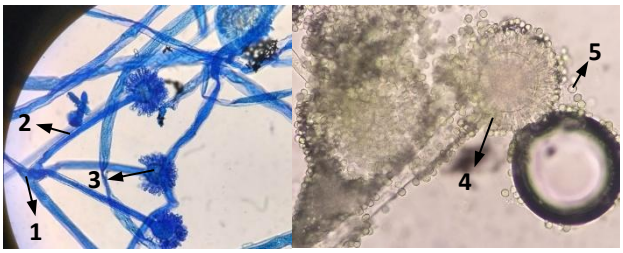

FIGURE 2. *Aspergillus sp.* fungal colony

Image description:
1. Hyphae
2. Conidiophores
3. Vesicles
4. Sterigmata
5. Conidia

Based on Figure 2, with the characteristics of fungi showing hyphae, conidiophores, vesicles, sterigmata, and conidia, the fungus is *Aspergillus sp.*

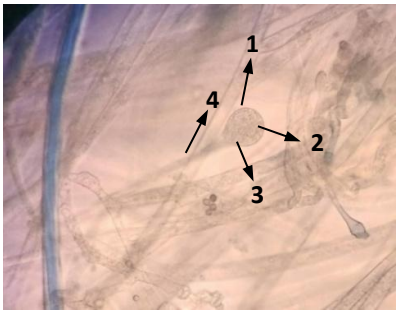

FIGURE 3. *Mucor sp.* fungal colony

Image description:
1. Sporangium
2. Spores
3. Collumella
4. Sporangiosphere

Based on Figure 3, with fungal characteristics including a sporangium, spores, collumella, and sporangiosphere, the fungus is *Mucor sp.*

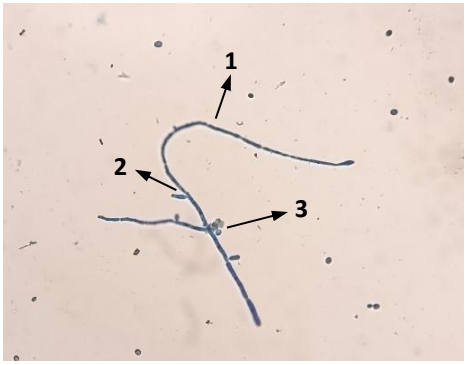

FIGURE 4. *Trichophyton sp.* fungal colony

Image description:
1. Hyphae
2. Cigar-shaped macroconidia
3. Microconidia clustered like grapes

Based on Figure 4, with the characteristics of fungi including hyphae, cigar-shaped macroconidia, and grape-like microconidia, the fungus is *Trichophyton sp.*

TABLE 3. Percentage of positive dermatophyte and non-dermatophyte fungi on the fingernails of warteg employees in Pekalongan Regency based on genus

Genus	Results	Percentage
Trichophyton sp	5	17%
Microsporum sp	-	-
Epidermophyton sp	-	-
Aspergillus sp	18	60%
Candida sp	26	87%

Based on Table 3, it can be seen that the positive results for dermatophyte fungi were only from the genus *Trichopyton sp* with a percentage of around 17%, while the positive results for non-dermatophyte fungi from the genus *Candida sp* obtained a percentage of 87% and the genus *Aspergillus sp* obtained 60%.

TABLE 4. Percentage of positive dermatophyte and non-dermatophyte fungi on the fingernails of warteg employees in Pekalongan Regency based on species

Spesies	Results	Percentage
Trichophyton mentagrophytes	2	7%
Trichophyton rubrum	3	10%
Aspergillus sp	18	60%
Candida sp	26	87%

Based on Table 4, it can be seen that positive results for dermatophyte fungi from the genus *Trichopyton sp* were obtained from the species *Trichophyton rubrum* at a rate of 10% and the species *Trichophyton mentagrophytes* at a rate of approximately 7%. Positive results for non-dermatophyte fungi with the species *Aspergillus sp* were obtained at a rate of approximately 60%, while the species *Candida sp* was obtained at a rate of 87%.

Discussion

The examination results from 30 fingernail samples taken from food stall employees showed positive results for *Trichopyton sp* dermatophyte fungi with a

percentage of approximately 17% (5 samples), then positive results for non-dermatophyte *Candida sp* fungi with a percentage of 87% (26 samples), and *Aspergillus sp* fungi with a percentage of 60% (18 samples). These positive results were found in the genus *Trichopyton sp* with colonies that were yellowish brown to reddish brown in color, powdery or velvety in texture, and with a prominent shape in the center. The morphology observed under a microscope showed hyphae, round microconidia clustered like grapes, and macroconidia shaped like clubs. Other positive results found in the *Candida sp* genus can be seen from macroscopic observations with yellowish-white colonies, with a smooth surface that is slightly slimy and slippery, round in shape (the shape can also vary) that arise on the media. The morphology seen microscopically found blastospores and chlamydiospores. Positive results for the genus *Aspergillus sp*. were also observed with colonies that were black, white, or green in color, with a granular or velvety texture. Microscopic observation revealed conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to the conidia.

The highest number of samples in this examination was in the non-dermatophyte group with 44 samples. This could be due to the habits of some food stall vendors who do not maintain good hygiene of their fingernails. Based on the following questionnaire results, there are several habits that can cause fungal infections in fingernails, including cutting nails in intervals of more than 2 weeks, habits during work where hands are too often in direct contact with water, causing them to become moist, and not many people wearing gloves while working. Several other factors that can contribute to non-dermatophyte fungal infections on fingernails include a humid environment and jobs that involve frequent exposure to water, which increase the risk of non-dermatophyte fungal infections on fingernails.

The high prevalence of non-dermatophyte fungi in this study is in line with a previous journal by (Mayumi, Habibah and Suyasa, 2023), which showed the results of examining nail clippings from chicken meat traders in the village of Nunuka Raya, Tomini District, South Bolaang Mongondow Regency, using the SDA culture method. Of the 30 samples, 18 (60%) were positive for *Aspergillus sp*, 10 (33%) were positive for yeast, and 10 (33%) were positive for *Trichopyton sp.* From these results, 28 nail clipping samples were infected with non-dermatophyte fungi. In the journal (Husen, Khasanah, and Ina Ratnaningtyas, 2024), findings on rice farmers' nails also revealed *Candida albicans* fungal species in 12 samples (60%), Aspergillus flavus fungal species in 6 samples (30%), and 2 samples (10%) of the fungus *Rhizopus stolonifer*.

Conclusion

Based on the results of research identifying dermatophyte and non-dermatophyte fungi on the fingernails of food stall employees in Pekalongan Regency, it can be concluded that the examination conducted using culture on SDA media and observed macroscopically and microscopically is as follows:

1. *Candida sp* fungi were found to be positive with macroscopically yellowish-white colonies, smooth, slightly slimy and slippery surfaces, and round shapes that appeared on the medium. Microscopically, blastospores and chlamydiospores were found. *Aspergillus sp*. fungi had black, white to green colonies with a granular or velvety texture. Microscopic observation revealed conidiophores, septate and branched hyphae, round vesicles, round conidia, and long sterigmata attached to conidia. *Trichopyton sp* fungi have colonies that are yellowish brown

to reddish brown in color, with a powdery or velvety texture, and a prominent shape in the center. Microscopic morphology shows hyphae, round microconidia clustered like grapes, and club-shaped macroconidia.

2. Positive fingernail samples showed the presence of *Candida sp* in 26 samples (87%), *Aspergillus sp* in 18 samples (60%), and *Trichopyton sp* in 5 samples (17%).

Acknowledgement

The author would like to thank all those who have helped in the implementation of this research so that it could be completed smoothly.

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