ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

PREVALENCE OF DERMATOPHYTES AND NON-DERMATOPHYTE FUNGAL INFECTION AMONG PATIENTS VISITING DERMATOLOGY CLINIC, AT TIKUR ANBESSA HOSPITAL, ADDIS ABABA, ETHIOPIA.

BY

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Abbreviations

AIDS acquired immuno deficiency syndrome

EHNRI Ethiopian Health and Nutrition Research Institute

LPCB Lacto-Phenol Cotton Blue

NDM Non-Dermatophyte moulds

HIV human immuno virus

PDA Potato Dextrose Agar

SDA Sabrouad's Dextrose Agar

SPSS Statistical Packages for Social Sciences

Abstract

Back ground: Dermatomycosis is a common fungal infection that constitutes public health problem among humans and animals worldwide, including Ethiopia. Though it is a trivial disease, its psychological effect and morbidity in terms of loss of time and treatment cost is considerable.

Objective: To describe the most dominant clinical manifestation, the dominant fungi implicated as a cause of dermatomycosis and determine the prevalence of dermatophytes, non-dermatophyte fungi and yeasts collected from clinical samples suspected of dermatomycosis.

Material and methods: a cross sectional descriptive study design from January to May, 2014 was conducted at Tikur Anbessa Hospital. Scrapings from skin nail and scalp of 305 study participants was collected by employing standard routine microbiological techniques. A portion of each sample was placed on a slide and a drop of an aqueous solution of 10% (w/v) potassium hydroxide, was added. After 5 minutes, the wet mount was examined under low (X10) and high (X40) power magnification for the presence of fungal elements. The remaining portion of each clinical sample was cultured irrespective of the negative or positive direct microscopic examination results. Each sample was streaked on two plates of Sabouraud's dextrose agar (SDA) with chloramphenicol and SDA, with chloramphenicol and cychloheximide which were prepared according to the manufacture's instruction. All inoculated plates were then incubated at inverted position for 4-6 weeks at 25-30^{0}C aerobically. Incubated plates were examined twice a week for any fungal growth. Colonies suspected of dermatophytes were sub-cultured into potato dextrose agar for the production of spores. Mold isolates were identified by examining macroscopic and microscopic characteristics of their colony. Microscopic identification of mold isolates was performed by placing pieces cultures from SDA and/or PDA to clean microscopic slide and staining with lactophenol cotton blue. After placing a cover slip, each preparation was observed microscopically. Yeast identification, C. albicans was differentiated from other yeasts by germ tube production. Data was analyzed using SPSS version 20 software.

Result: A total of 305, study participants were enrolled in the present study of which 97 (31.8%) were males and 208 (68.2%) females. The ages of study subjects ranged from 1 to 80 year with a mean age of 26 years. Out of the 305 study subjects, fungal species were detected (direct microscopy) in 166 (54.4%) of clinical samples while 242(79.3%) clinical samples were culture positive. Sixteen clinical samples that were culture negative were positive by direct microscopy. The three predominant clinical manifestation were tinea ungium accounting 156(51.1%) of

clinical manifestations of which 119 (76.3%) were in females and 37(23.7%) in males. This was followed by tinea capitis accounting 61 (20%) of which 37 (60.7%) in females and 24 (39.3%) in males followed tinea corporis accounting 33(10.8%) of which 26 (78.8%) in females and 7 (21.2 %) in males. Fungal species belong to dermatophyte; non-dermatophyte molds and yeasts were isolated and identified from 242 patients. Dermatophytes were isolated in 129 (53.3%) of culture positives followed by non-dermatophyte molds 60 (24.8%) and this was followed by yeast that accounted 53 (21.9%). Fungal groups that were predominant in clinical sites in descending order were dermatophyte, followed by non dermatophyte molds and the least were yeasts. Among dermatophytes T. *violaceum* and *T.mentagrophyte* were the dominant ones.

Conclusion: The prevalence of fungi that cause different manifestation of dermatomycosis was high, which was 79.3%. Though dermatophytes were the predominat group the isolation rate of non-dermatophyte fungi and yeasts was also considerable indicating that the spectrums of fungi causing dermatomycosis are diverse.

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1. Introduction

1.1. Background

Dermatophytosis is a fungal infection of the keratinized tissues such as skin, hair and nails of humans and animals [1]. The mycosis is caused by a group of closely related fungi, dermatophytes consisting of 40 species belonging to three genera: *Trichophyton, Microsporum* and *Epidermophyton.* Theycan also be classified into three broad categories: the anthropophilic, the zoophilic, and the geophilic species. This differentiation with respect to natural habitats and host preferences is believed tohave played a significant role in determining the global distributions of the dermatophytes [2].

Ringworm is usually classified as different types of tinea depending up on the site of human body mycoses manifested. Reaction to a dermatophyte infection may range from mild to severe as a consequence of the host's reactions to the metabolic products of the fungus, the virulence of the infecting strain or species, the anatomic location of the infection, and local environmental factors [3].

Non-dermatophytic fungi associated with dermatophytoses e.g tinea cruris (groin), tinea capitis (scalp), tinea unguium (toe nails), tinea faciae (face) , tinea pedis (toe web), tinea manuum (palm), tinea barbae (beard and neck) and tinea corporis (non-hairy parts of the skin), has been reported by many authors [4-5].

Superficial mycoses (ringworm) are among the most frequent forms of human infections, being estimated to affect more than 20-25% of the world's population, and their incidence is constantly increasing [4].

A very significant variation in the pattern of dermatophytosis in different countries is clearly reported by several researchers [6-9]. The heterogeneity in the distribution pattern of dermatophytosis and their causative agents in different parts of the world have been attributed to factors, such as age, sex, genetics, race, climatic factors, lifestyle, migration of people, cultural practices and socioeconomic conditions, incidence of peculiar comorbidities and drug therapy [2,10-13].

In recent decade, the prevalence of dermatophytosis has significantly reduced in many developed nations of the world compared to the developing ones due to improved social, economic, health care and hygiene practice factors evident in the former [4]. Ethiopia being a developing nation located in the tropics with wet humid climate fell into the category of regions with high prevalence of dermatophytosis.

Several studies from the African continent have investigated the epidemiology of dermatophytosis in order to guide choice of empiric therapy [4, 16, 20, 22-27]. However, to the best of our knowledge, only two studies: dermatophytosis in children in a geographically restricted area (Tulugudu Island) and prevalence of tinea capitis on children attending two schools have been published describing the spectrum of dermatophytosis [14, 15]. And this indicates that the prevalence of dermatophytosis and its etiologic agents in Ethiopia are not adequately addressed. Furthermore, as the epidemiology of dermatophytosis is changing over time it is important to review periodically the incidence of dermatopphytes and their distribution. To this end the present study was undertaken to isolate various fungal agents (dermatophytes and non-dermatophytes) causing superficial mycoses among patients attending dermatology clinic at Tikur Anbessa hospital which has got an average new outpatient turnover of 15-20 per day.

1.2. Statement of the Problem

Superficial mycoses are among the most frequent forms of human infections, being estimated to affect more than 20-25% of the world's population, and their incidence is constantly increasing particularly in developing nations. Although ringworm is considered to be a trivial disease the psychological effects of ringworm is highly considerable and because of its high morbidity it is a costly disease in terms of loss of working days and treatment. Although ringworm is predominantly caused by dermatophytes, non dermatophytic fungi are becoming increasingly implicated in causing ringworm.

The distribution of dermatophyte infections and their causative agents varies with geographical region and is influenced by a wide range of factors, such as type of population, climatic factors, lifestyle, migration of people, cultural practices and socioeconomic conditions and drug therapy. The prevalence of dermatophytosis and the predominant etiologic agents, the different types of tinea and risk factors have been established in most part of the world.

InEthiopia, however the prevalence of dermatophytosis, the predominant dermatophytes and non-dermatophytic fungi that cause dermatophytosis and the predominant types of tinea are poorly known. Therefore, determining the prevalence of dermatophytosis and its etiologic agents and the different types of dermatophytosis in Ethiopia is timely and an active field of study.

1.3. Significance of the Study

The results obtained in this study may be used as a baseline data for epidemiological studies of dermtophytosis in the country, Knowledge of the prevalence of dermatophytosis, provides relevant information on the extent of the disease epidemic, and helps to identify infection control mechanisms and selection of appropriate antibiotics for empiric treatment. Dermatophyte isolates obtained in this study can be used for further study such as drug susceptibility study.

2. Literature review

A study investigated the prevalence of dermatophytes and non-dermatophytes fungi as etiological agent of dermatophytosis among Islamiyya school children of ages 5 – 13 years old in Kano metropolis, Nigeria from March to August, 2008. From a total of 100 students demonstrated visible clinical signs of dermatophytic infections, fungi were isolated from 91 (91%) students from which 66 (72.5%) were identified from males and 25 (27.5%) from females respectively. Dermatophytes amounting to 53 (58.2%) in frequency were recorded out of which 39 (73.6%) were isolated from males and 14 (26.4%) on females. Non-dermatophytes were also more in males (27 isolates) than females which had 11. The etiological agents of dermatophytoses recorded in this study in descending order of prevalence were *M. ferrugineum* (15.4%), *M. canis* (15.4%), *M. audounii* (9.9%), *T. concentricum* (5.5%), *T.verrucosum* (3.3%), *T. rubrum* (3.3%), *T. mentagrophyte* (2.2%), *T. tonsorans* (1.1%) and *T. schoenleini* (1.1%). *A. flavus* (9.9%), *A. niger* (8.8%), *Penicillium* sp. (7.7%), *Candida albicans* (5.5%), *Mucor* sp. (4.4%), *Trichoderma* sp.(3.3%) and *A. fumigatus* (2.2%) constituted the non-dermatophytes associated with these cutaneous infections. Higher frequency of dermatophytosis occurred more in children with greater propensity for play, interaction with domestic animals and who lacked the luxury of school seats during classroom learning [4].

An occurrence and causative agent of dermatophytosis in and around Tiruchirapalli, Tamilnadu, India was investigated in 2012. A total of 519 samples were collected from nails, skin and hair for one year. The results of this study showed that dermatophytosis was more in the age group of 11-20 and 21-30 years; Tinea corporis (35.4%) was the predominant clinical condition followed by tinea cruris (16.8%) and tinea capitis (16.7%); Tinea capitis was common in children below 12 years; males were affected more than the female (67.1%); presence ofdermatophytes in 70% of the samples and *T. rubrum* was the predominate pathogen followed by T. *mentagrophyte* [16].

Retrospective epidemiologic study was carried out at the Referral Center of Southwest Iran between March 2005 and March 2007 in 2011. Out of 428 study subjects, 233 (54.43%) men and 195 (45.56%) women, most of them aged 20-29 (29.8%). Tinea cruris and tinea corporis were the most common clinical presentation in both men and women. *Epidermophyton floccosum* was the most frequently isolated dermatophyte (39.25%), followed by *T. verrucosum* (27.33%) and *T. rubrum* (8.41%)[17].

A study investigated the epidemiology of dermatophytes in the eastern province of Saudi Arabia from March to February, 2008. This study depicted that out of a total of 250 samples dermatophytes were recovered from 178 (71.54%). Dermatophytes (E. *floccosum, M. canis, M. gypseum, T. Mentagrophytes, T. rubrum, T. schoelneinii, T soudanense, T. violaceum and T. verrucossum) and non*-dermatophytes (*Candida albicans, C. krusei, C. tropicalis*, and *Fusarium solani*) were at different sites of the body. In relation to age, the percentage infection of tinea capitis and tinea corporis were found to be higher in the age group of 0-15 years, while tinea pedis and tinea cruis dominated in the age group of 16-30. Recovery of dermatophytes above age of 60 years was very low [5].

A study of the spectrum of dermatophytoses by means of a retrospective analysis involving 6,133 patients referred to the Mycology Service of the Dermatology Clinic of Policlinico Hospital- University of Bari, Italy during the period 2005-2010. The results of this study revealed that the most frequent clinical forms were tinea unguium (39.2% of the total dermatophytoses), tinea corporis (22.7%) and tinea pedis (20.4%). There was predominance of women for tinea unguium and corporis and of men for tinea pedis and especially tinea cruris. *T. rubrum* was the prevalent causative agent, implicated in 64% of total cases, followed by *M. canis* (14%) and *T. mentagrophytes* (10%) [18].

To isolate and identify the fungal agents from clinical samples from 165 patients with different mycoses was carried out by microscopic and culture method. Clinical samples from 165 patients were subjected to potassium hydroxide (KOH) examination and culture isolation; causative agents were identified macroscopically and microscopically. The results of their study showed that 110 samples (66.7%) were KOH positive; dermatophytes were isolated in 53(66.3%) specimens; and *T. rubrum* was the commonest isolate in skin samples (70.8%) among the patients suffering from dermatophytosis. The highest isolation rate was candidiasis (100%) and *Phaeoannellomyces werneckiw*as isolated in one patient [19].

A 4-months descriptive cross-sectional survey to determine the prevalence, clinical types as well as the etiologic agents was carried out among 602 children aged 5-16 in Oke-Oyi community in Kwara state, Nigeria in 2011.This study showed that **t**he prevalence of clinically suspected dermatophytoses lesion was 29.9% (180/602); dermatophyte accounted for 5.0% (30/602) of the isolates; non-dermatophyte fungi represent majority of isolate (15.4%: 93/602; tinea capitis was the commonest clinical type, followed by tinea corporis and then tinea pedis;

multiple infections are noted in nine respondents; three species of dermatophytes were responsible for human infection in the area studied, of which *T.rubrum* was the commonest, followed by *M. audouinii* and *T. verucossum*. Among the non-dermatophytes, A. *fumigatus* and *C. albicans* were predominat [20].

A Cross- sectional descriptive study to determine the prevalence and aetiology of dermatophyte infections in relation to social economic factors comprising a total of 422primary school children of ages between 5-15 years in Kibera, Nairobi was conducted from September 2006 and February 2007. The prevalence of dermatophytoses was 11.2% with tinea capitis being the most common type. The highest infection rate occurred among six to eight years age in both sexes compared to other age groups. *T. violecium* (35), *T. mentagrophytes* (3), *T.* terestre (3), *T. schoenleinii (*2), and *T. interdigitale* (1), *M. canis*(2), *M. equinum*(1) and *E. flocossum*(1). *T. violecium* was the predominant species isolated, at 35/48(71%) followed by *T. mentagrophytes* and *T. terrestre* at 3/48 (6%) each. Poor living environment, children interaction patterns and poor health seeking behavior were factors contributing to the high frequency and chronic occurrences of ring worm [21].

Prevalence of non dermatophyte molds in patients with abnormal nails involving 32 patients was carried out in Egypt. The prevalence of non dermatophyte molds was greater than dermatophytes. Non dermatophyte moulds were isolated from 19 cases (59.4 %) of which *Aspergillus species* being the commonest isolates accounting 47%. Deramtophytes were isolated in only five patients (15.6%) of which *M. canis* and *T. violaceum* being the most common dermatophytes. Yeasts were isolated in only three patients (9.4%)[22].

Four hundred two prison inmates in Abakaliki, Nigeria were screened fungal skin infections. Of 402 study subjects 70 (19.7%) showed skin lesion of fungal infection. Dermatophytes were recovered from 61 (77.2%) skin lesions of study subjects while non dermatophytes accounted for 18 (22.8%) of the lesions. The dermatophytes recovered were mostly anthropophilic and include *T. rubrum* 33 (41.8%), *T. mentagrophytes var. interdigital* 3(3.8), *T. tonsurans* 3(3.8%) *T. violaceum* 2 (2.5%) *E. floccusum* 10 (12.7%).*T. rubrum* was the most frequently recovered dermatophyte (41.8%) and caused infections in a varity of sites. A zoophilic dermatophyte, *M. canis* was recovered from 10 (12.7%) cases. *C. albicans* 15 (19%) and candida species 3 (3.8%) were non dermatopyte fungi recovered from study subjects. The groin was the most common site of infection being infected in 50% of the cases by both

dermatophytes and non dermatophytes. Younger inmate (17-24 years) recorded the highest prevalence of infection (45.6%) and newer inmates (> 2 years) were found to be more infected than older ones [23].

A total of 396 consecutive cases of suspected dermatophytoses among white and Bantu patients were investigated between October 1970 and March 1973 at the dermatology Clinics of the National and Pelonomi Hospitals in Bloemfontein, South Africa. The results of this study showed that Tinea capitis occurred predominantly in Bantu children and tinea corporis was found most often in white children. *T. violoceum* and *M canis* were the most frequent causes of these conditions. Tinea pedis and tinea cruris were found exclusively in white adults and were more common in males than females. *T. interdigitals, E. floccosum* and *T. rubrum*, in that order of frequency were the causative agents of these conditions. Favus due to *T. schnleinii* occurred but was found only in Bantu children. Infections caused by *T. mentagrophytes, M. audouinii* and *M. gypseum* were very rare [24].

A study to determine the dermatophyte flora in the North West region of Algeria at the dermatology outpatient clinic of Oran University Hospital Center involving a total of 121 patients was conducted in 2007. Dermatophytes were isolated from 39.67% study subjects of which a total 11 different species of dermatophytes were isolated. Of the total isolates 66.68%, 24.99 % and 8.33% were accounted by *Trichphyton, Microsporum* and *Epidermatophytes* species[25].

Skin scrapings collected from 2224 patients attending the dermatology clinic at Tripoli Medical center with suspected fungal infection were investigated in a 28- month study period from August 1997 to December 1999 in 2001. Of the study population 1180 (53.1%) were diagnosed microscopically while 1160 (52.2%) were culture positive. Dermatophytes, *Malssezia furfur* and *candida albicans* were the major etiological agents. Tinea corporis accounted for 45.9% (85%) occurred in children below 15 years of age. The frequency of other clinical types in decending order was pityriasis versicolor, 27.8% (322 cases), candidiasis 13.4% (156 cases), tinea pedis 8.1% (94 cases), tinea manuum 2.6% (30 cases) and tinea barbae 2.2% (26 cases). *T. violaceum* was the most common etiologic agent and was responsible 44% (300 cases) of dermatophyte infections. *M. furfur* ranked second in frequency with 27.8% (322 cases) followed by *T. rubrum* 13.8% (160 cases), and *C. albicans* 10% (116 cases)[26].

A survey of 1620 school children was under taken to assess the prevalence of T. capitis in three different towns in India in 1970. Nineteen mycologically proved cases of tinea capitis were identified of which *T violaceum* was found out to be the predominat species followed by *T. mentagrophytes [*27].

A study of tinea capitis in Sri Lanka was undertaken between January 1978 and December 1987. Of 106 cases of tinea capitis 85% of the infection occurred in children below 15 years of age and 76% in children under 10 years of age. *T. mentagrophytes, M. canis* and *M. gypseum* were responsible for 81 % the infection [28].

A study of the incidence of dermatophytosis in Kuait Showed tinea capitis was in 71.1% of 135 patients with dermatophytosis, with a higher incidence (48.2 %) in males than females. *M canis* caused 60.7% of all cases of dermatophytosis and 76% of tinea capitis [29].

A study on the prevalence and etiologic agents of dermatophytosis in our patients attending the dernmtology center of Avicenna Hospital in Qazvin, Iran was carried out between 2006 and 2007. Out of 1023 subjects suspected to have cutaneous mycosis, 348 (34%) patients were affected with dermatophytosis. Of eight dermatophytes *E, floccusum* the most frequently isolated species representing 32.8% and the most common type of infection was tinea cruis accounting 31.9%[30].

A survey of dermatophytes and dermatophytoses was carried out among patients of the department of dermatology, Medical University of Gdansk, Poland, in the years 1984- 1995. Over a 19 years period, 1195 cases of ringworm seen. Of which 55% and 45% were males and females respectively. Listing the dermatophytes isolated and their frequencies as the percentage of the total are as follows: *T. mentagrophytes* 42.1%, *M. canis* 26.0%, *T. rubrum* 14.7%, *E. floccosum* 11.0%, *T. tonsurans* 4.6% *T. verrucosum*1.3% *T. violaceum* 0.3%. The most common dermatophytosis was T. cruris (32.9%), followed by tinea pedis (24%) onycomycosis (16.5%), tinea capitis (11.9%), tinea inguinalis (10.3%) and tinea manuum (4.4%)**[**31].

A total of 557 children of aged from 0 to 18 years attending Deparment of Dermatology, Venerology and Allergology of Gdank, Poland investigated for dermatophytose for three years. Dermatophytoses was demonstrated in 94 study subjects. The most frequent pathogen was *M. canis* (62%) and *T rubrum* (12%). The most common forms of dermatophytoses in children were Tinea cutis glabrae and tiena capitis accounting 42 and 30 % respectively. T. pedis was observed

mainly in adolescents (above the age of 12 years) - the majority of cases were caused by T. rubrum, and T. mentagrophytes [32].

A study of dermatophytes over a period of 17 years (1966- 1982) at the Australian National Reference laboratory in medical mycology identified 4354 isolates of deremtophytes. Among the isolates the most frequently isolated species was *T. rubrum* accounting 35.3% followed by *T. mentagrophytes* (26.5%), *T. tonsurans* (12. 8%) *E. floccosum* (10.7%) and *M. canis* (8.4%)[33].

A retrospective study from 2002 to 2004 on the epidemiology of dermatophytic infections in Rome, Italy was conducted in 2007. Of 3160 subjects studied, 1275 (40.3%) were positive for fungal infections; of which only 252 (19.2%) had infections caused by dermatophytes. The dermatophyte most frequently isolated was *M. canis* [34].

A 7 years (1997-2003) survey of dermatophytoses in Crete, Greece was conducted in 2007. Of a total of 5544 samples (skin, hair and nail) obtained from 3751 patients dermatophytes were isolated from 520(13.9%) patients. *T. rubrum* was the most frequently isolated dermatophyte accounting for 48% of the isolations, followed by *M. canis* (17.9%), *T. mentagrophytes* (14.2%), and *E floccosum* (6%). tinea unguium, tinea pedis, tinea. corporis, tinea capitis, tinea cruis, tinea mauum and tinea facei were the clinical types of dermatophytoses in decreasing order of frequency[35].

A study on dermatophytoses in mycology laboratory of the Venereal disease hospital in Thessaloniki, Northern Greece was conducted between 1981and 1990. The study revealed that of 6572 isolates of different dermatophytes were obtained from 17120 patients of which the most prominent dermatophyte was *T. rubrum* (62.8%) followed by *M. canis* (13.7%), *E. flocccosum* (10.8%), and *T. mentagrophytes* (8.4%) representing 95.6% dermatophytes isolated. The most frequently affected areas were the feet (30.2%), followed by the body (21.4%), urogenital folds (20.3%), the toe nails (11.7%), and the scalp (4.8%) [36].

In Ethiopia the prevalence of dermatophytose was shown to be 57.3% in children being t.capitis the commonest manifestation (76.5%). *T. violacum* (80.6%) was the leading isolate followed by *T. verrucosum* (16.3%) and *T.tonsurans* 2%. 74.1% were microscopy-positive and 73% culture positive for dermatophytes [15]

3. Objective

3.1. General objective

To determine the prevalence of dermatophytes and non-dermatophyte fungal infection among patients attending to the dermatology clinic, at Tikur Anbessa hospital, Addis Ababa.

3.2. Specific objectives

- To describe the most dominant clinical manifestation in the study site, at Tikur Anbessa Hospital.
- To determine the most dominant fungus implicated as a cause of dermatomycosis.
- To determine and compare the prevalence of dermatophytes and non-dermatophyte fungi collected from clinical samples suspected of dermatomycosis.

4. Hypothesis

- The prevalence of dermatomycosis in the study site is very high.

5. Materials and Methods

5.1. Study Setting and Period

The study was conducted at Tikur Anbessa Hospital, Addis Ababa, Ethiopia from January to May, 2014. It is a tertiary level referral and teaching hospital administered by the Addis Ababa University. The hospital consists of an operating room, intensive care unit and 13 wards with a bed capacity of 500. It provides health care services to patients in and around Addis Ababa, the capital city of the country.

5.2. Study Design

A cross sectional descriptive study was conducted from January to May, 2014.

5.3. Population

5.3.1. Source Population

The source populations were patients attending dermatology clinic at Tikur Anbessa Hospital.

5.3.2. Study population

Patients suspected of dermatomycosis and referred to the laboratory at Tikur Anbessa hospital.

5.4. Sample Size and Sampling Procedure

Convenience sampling technique was used, in which clinically suspected cases of superficial mycoses prescribed by physicians were included. Studies on the prevalence of dermatophytes and non-dermatophytes are very few in Ethiopia. According to a five year retrospective study on 2367 subjects prescribed by physician from 2004 to 2008; at EHNRI Addis Ababa, Ethiopia the prevalence of dermatophytes and non-dermatophytes associated with cutaneous mycoses was 85.21% [37]. Hence I assumed previous prevalence to be 85.21%, 95% CI, and 5% margin of error and 10% for the non-response rate in determining my sample size for this study. Therefore the sample size is given as follows:

$$\mathbf{n} = \frac{(\mathrm{Z}\alpha/2)2\mathbf{P}\,(\mathbf{1}-\mathbf{P})}{\boldsymbol{d}\mathbf{2}}$$

Where: n = the sample size

$(Z\alpha/2)^2$ = at 95% confidence interval Z value ($\alpha = 0.05$) = 1.96

P = the proportion of occurrence of dermatophytes and non-dermatophyte fungi 85.21% (0.8521)

d = margin of error at 5% (0.05)

$$n = \frac{(1.96)2(0.8521)(1-0.8521)}{(0.05)2} = \frac{3.8416\ \mathrm{X}0.1260}{0.0025} = 193.6 = 194$$

$10\%\ \text{non response rate} = \frac{10\times}{100}194$ =19.4, the minimum Sample size is therefore 194+19.4=213.

5.5. Study variables

5.5.1. Dependent variables

- Prevalence
- Dermatomycosis

5.5.2. Independent variables

- Age
- Sex
- Site Infected

5.6. Inclusion Criteria

All patients clinically suspected of dermatomycosis to get direct microscopy tests were included at the study area and in the specified period of study from January to May, 2014.

5.7. Exclusion Criteria

Patients who did not give consent or assent to participate in the indicated study were excluded.

5.8. Data Collection Procedures

5.8.1. Demographic data

Age, sex and site of infection of each study subject were obtained from laboratory prescription form brought by the patient.

5.8.2. Sample collection and processing

Scrapings from the skin, nails and dull broken hairs and/or scalp scrapings after treating with 70% (v/v) ethanol were collected by the principal investigator and trained laboratory technologists of the hospital using sterile razor blades and epilator forceps and placed into sterile plates aseptically. Each plate was appropriately labeled with the patient's code and site of infection.

5.9. Detection, isolation and characterization fungal pathogens

5.9.1. Direct microscopy

A portion of each sample was placed on a slide and a drop of an aqueous solution of 10% (w/v) potassium hydroxide, KOH (Aldrich, Germany) were added. After 5 minutes, the wet mount was examined under low (X10) and high (X40) power magnification for the presence of fungal elements such as spores (arthroconidia, macro and/or microconidia and chlamydospores), yeasts, different types of reproductive structures and different types (hyphae, pectinate, anthler, racket and spiral hyphae).

5.9.2. Culture isolation of fungal pathogens

The remaining portion of each clinical sample was cultured irrespective of the negative or positive direct microscopic examination results. Each sample was streaked on two plates of Sabouraud's dextrose agar (SDA) with chloramphenicol and SDA, with chloramphenicol and cychloheximide (Oxide, Basingstoke, England) which were prepared according to the manufacture's instruction. All inoculated plates were then incubated at inverted position for 4-6 weeks at 25-30^{0}C aerobically. Incubated plates were examined twice a week for any

fungal growth. Colonies suspected of dermatophytes were sub-cultured into potato dextrose agar, PDA (Oxoid, Basingstoke, England) for the production of spores.

5.9.2.1. Identification and characterization of fungal pathogens

5.9.2.1.1. Identification of dermatophytes and non-dermatophyte fungi

Mold isolates were identified by examining macroscopic and microscopic characteristics of their colony. Texture, rate of growth, topography and pigmentation of the front and the reverse side of the culture were employed for the macroscopic identification. Microscopic identification of mold isolates was performed by placing pieces of culture colony from SDA and/or PDAto clean microscopic slide and staining with lactophenol cotton blue(BD). After placing a cover slip, each preparation was observed microscopically as indicated in section 4.8.3.1 above. Urea agar (Oxoid, Basingstoke, England) was used in the differentiation of *T. tonsurans, T. violacium* and *T. rubram. A* Color Atlas of Pathogenic Fungi by D.Frey, R.J.Oldfield, R.C.Bridge, 2000, 2ndedition, was used for microscopic and macroscopic identification of fungal isolates.

5.9.2.1.2. Yeast identification

Candida albicans was differentiated from other yeasts by germ tube production. Briefly, yeast suspension were inoculated in to serum human and incubated at 37^{o}C for fewer three hours. Germ production was detected from the wet mount of the serum.

5.10. Data Management and Quality Assurance

Media were checked for sterility by incubating at 25-30^{0}C for weeks. Data was cleaned and checked for completion before analysis and pre-test was done before regular data collection was started.

5.11. Data Processing and Analysis

Socio-demographic characteristics of study subjects, clinical manifestations and laboratory results were compiled and entered into SPSS version 20 software for analysis.

5.12. Ethical Consideration

The study was conducted after it was ethically reviewed and approved by the Department Research and Ethical Review Committee (DRERC) of Department of Medical Laboratory Science, College of Health Sciences, and Addis Ababa University. Ethical clearance was also obtained from Tikur Anbessa Hospital. Informed written consent and assented forms were obtained from participants before data collection. The respondents were given the right to refuse to take part in the study as well as to withdraw at any time during the study period. All

the information obtained from the study subjects were coded to maintain confidentially. When the participants were found to be positive for superficial mycoses, they were informed by the hospital clinician and received proper treatment.

5.13. Operational definitions

Dermatomycosis:-superficial fungal infection of the skin or its appendages caused by dermatophytes or other fungi.

Dermatophytes: - fungal organisms that require keratin for growth. These fungi can cause superficial infections of the hair, skin, and nails. Dermatophytes are spread by direct contact from other people, animals, soil, and from fomites.

Dermatophytosis:-any superficial fungal infection caused by a dermatophyte and involving the stratum corneum of the skin, hair, and nails, including onychomycosis and the various forms of tinea.

Mycoses:-A fungal infection in or on a part of the body

Tinea/***ringworm***: - Any of various fungal infections of the skin, hair, or nails caused chiefly by species of the genera *Microsporum, Trichophyton,* and *Epidermophyton*.

Tinea capitis:-a superficial fungal infection of the scalp seen most commonly in children.

Tinea corporis:-a superficial fungal infection of the non-hairy skin of the body, most prevalent in hot, humid climates.

Tinea cruris:-a superficial fungal infection of the groin.

Tinea pedis: - a chronic superficial fungal infection of the foot, especially of the skin between the toes.

Tinea unguium/**Onychomycosis**:-is a fungal infection of nails caused by dermatophytes, yeasts or non-dermatophytes mold

Non-dermatophyte moulds:-filamentous fungi that are commonly found in nature as soil saprophytes and plant pathogens

Yeast:-any of the various small, single-celled fungi that cause disease.

6. Result

6.1.Demographic analysis

A total of 305 study participants were enrolled in the present study, of which 97 (31.8%) were males and 208 (68.2%) were females as shown in table 1. The ages of the study subjects ranged from 1 year to 80 year with a mean age of 26 years.

Table 1:Distribution of clinical manifestation in relation to sex among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa, Ethiopia, 2014, (n=305).

Sex			Clinical Manifestation							Total
			T capitis	T corporis	T cruris	T ungium	T pedis	T faciei	T manum	
	Male	frequency	24	7	4	37	6	9	10	97
		%	39.3%	21.2%	100.0%	23.7%	40.0%	45.0%	62.5%	31.8%
	Female	frequency	37	26	0	119	9	11	6	208
		%	60.7%	78.8%	0.0%	76.3%	60.0%	55.0%	37.5%	68.2%
Over all		frequency	61	33	4	156	15	20	16	305
		%	20%	10.0%	1.3%	51.1%	4.9%	6.6%	5.2%	100.0%

T = tinea

6.2.Detection and isolation rates of fungi in clinical specimens

Out of the 305 study subjects, fungal species were detected (direct microscopy) in 166(54.4%) of clinical samples while 242(79.3%) clinical samples were culture positive. Sixteen clinical samples that were culture negative were positive by direct microscopy as shown in Table 2.

Table2:Detection(microscopy) and Isolation (culture)rates of fungal pathogens among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa,Ethiopia,2014,(n=305).

KOH Direct Microscopy Result	Culture result				Total
	Culture positive			Culture Negative	
	Dermatophytes Moulds	Non-Dermatophyte Moulds	Yeasts		
positive	95 31.1%	24 7.9%	31 10.2%	16 5.2%	166 54.4%
Negative	34 11.1%	36 11.8%	22 7.2%	47 15.4%	139 45.6%
Total	129 42.3%	60 19.7%	53 17.4%	63 20.7%	305 100.0%
Over all rate	Over all fungi prevalence 242(79.3%)			63 **(20.7%)**	305 100%

6.3.Clinical manifestation in study subjects

As can be seen in table 1, the three predominant clinical manifestations were tinea ungium accounting 156(51.1%) of which 119 (76.3%) were females and 37(23.7%) were males. This was followed by tinea capitis accounting 61 (20%) of which 37 (60.7%) were females and 24 (39.3%) were males and followed by tinea corporis accounting 33(10.8%) of which 26(78.8%) were females and 7 (21.2%) were males respectively.

All clinical manifestations tinea capitis, tinea corporis, tinea ungium, tinea pedis and tinea facei, were higher in females but tinea cruris and tinea manum were higher in males as shown in table1.

6.4.Fungal pathogens isolated in the study subjects

Fungal species belonging to dermatophyte; non-dermatophyte moulds and yeasts were isolated and identified from 242 patients. As shown in figure1, dermatophytes were isolated in 129 (53.3%) followed by non dermatophyte molds 60 (24.8%) and this was followed by yeasts that accounted 53 (21.9%) of the isolates.

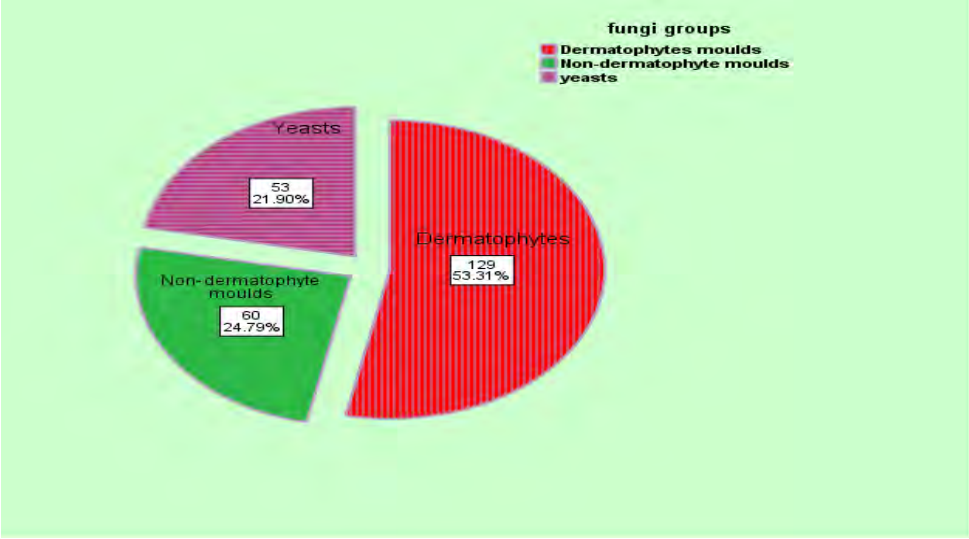

Figure1. Composition of etiologic agents of skin, hair and nail mycoses among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa, Ethiopia, 2014, (n=242).

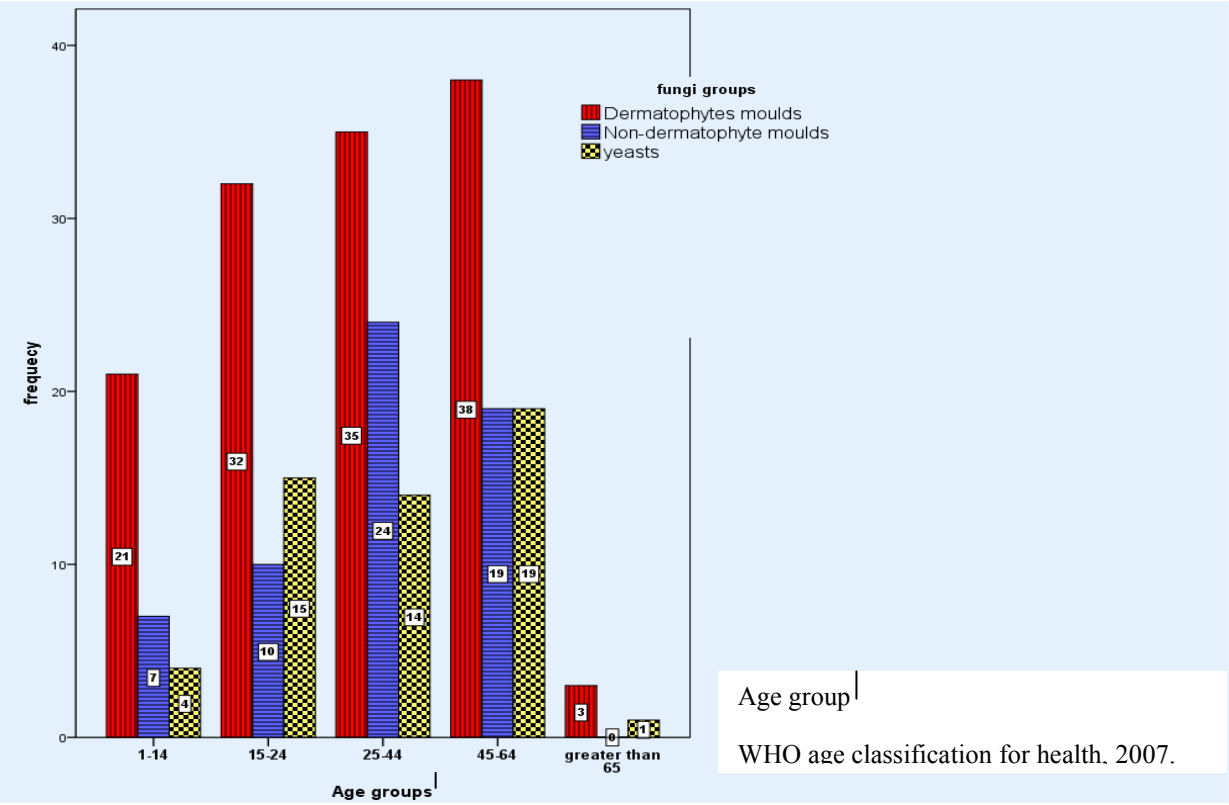

Figure 2.Distribution of dermatophytes, non-dermatophytes and yeasts in different age groups among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa,Ethiopia,2014,(n=242).

Dermatophytes were the predominant in all age groups as shown in Figure 2 above.

Out of the total culture positive subjects (242), 173 (71.5%)of the culture isolates were from females and 69(28.5%) of the isolates were from males as shown in table3.

Table3:Distribution of fungal pathogens in males and females among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa,Ethiopia,2014,(n=305).

	Sex				Total	
	Male		Female			
	Frequency	%	Frequency	%	Frequency	%
T.violacem	12	24.5%	37	75.5%	49	100.0%
E.flocosum	2	50.0%	2	50.0%	4	100.0%
C.albicans	4	20.0%	16	80.0%	20	100.0%
Other yeasts	10	30.3%	23	69.7%	33	100.0%
Apergillus species	5	33.3%	10	66.7%	15	100.0%
Cladosporuim Species	4	22.2%	14	77.8%	18	100.0%
Fusarium species	0	0.0%	2	100.0%	2	100.0%
E.wernkii	6	46.2%	7	53.8%	13	100.0%
Alternaria	1	20.0%	4	80.0%	5	100.0%
Curvularia species	0	0.0%	1	100.0%	1	100.0%
Pedrahortae	0	0.0%	1	100.0%	1	100.0%
T. Sudanese	2	40.0%	3	60.0%	5	100.0%
pencillium species	1	25.0%	3	75.0%	4	100.0%
T. mentagrophyte	13	56.5%	10	43.5%	23	100.0%
T.tonsurans	4	19.0%	17	81.0%	21	100.0%
T.rubrum	2	18.2%	9	81.8%	11	100.0%
T.schoeinleini	0	0.0%	8	100.0%	8	100.0%
T. verrucosum	2	50.0%	2	50.0%	4	100.0%
M. audoini	1	25.0%	3	75.0%	4	100.0%
M. nanum	0	0.0%	1	100.0%	1	100.0%
Total	69	28.5%	173	71.5%	242	100.0%

6.5.Fungal pathogen in relation to anatomical site

As can be depicted in Figure3, dermatophytes, non-dermatophytes and yeasts were isolated in almost all anatomical sites. Fungal groups that were predominant in clinical sites in descending order were dermatophytes, followed by non-dermatophyte molds and the least were yeasts. The largest number of fungal isolates was recovered from tinea capitis, tinea ungium and tinea corporis. Of all fungal isolates recovered in tinea capitis in descending order were dermatophytes (38 spp.), yeasts (5spp.) and non dermatophyte molds(2 spp.) Among the dermatophytes, *Trichophyton violaceum* and *Trichophyton tonsurans* were the dominant ones. The same groups of fungi were also recovered from nail, of which (49) were dermatophytes while non dermatophyte molds (39) among which *Aspergillus* spp and *Cladosporum* spp. accounted 11 and 12 spp. respectively. Thirty nine species of yeasts were also recovered from nail of which *Candida albicans* was the predominant consisting of 18. Among fungal groups isolated in tinea corporis, 19 species were dermatophytes followed by non-dermatophyte accounting 8 isolates.

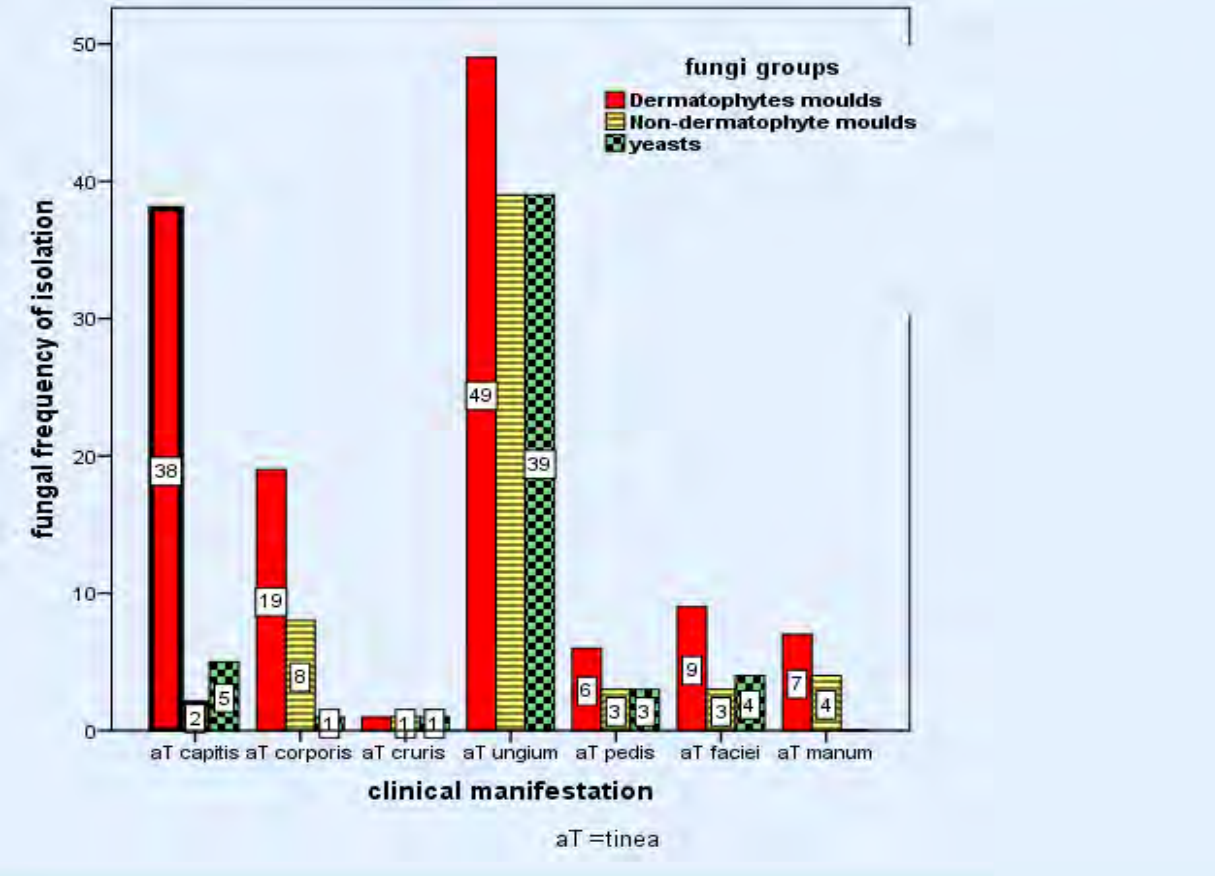

Figure 3.Distribution of dermatophytes, non-dermatophyte molds and yeasts on different site of the body among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa,Ethiopia,2014,(n=242).

The percentage of isolates to the total of culture positive samples in different clinical sites in descending order were *T.violacem* 49(20.2%), *T.mentagrophyte* 23(9.5%), *T.tonsurans* 21(8.7%), *C.albicans* 20(8.2%), *Cladosporium species* 18(7.4%), *Aspergillus species* 15(6.2%) respectively as can be shown in the right most of table4.

The predominant etiologic agents of tinea capitis tinea ungium, tinea facei, and tinea corporis was *Trichophyton violacem* while tinea cruris, tinea manum and tinea pedis were predominated by *Trichophyton mentagrophyte* as shown in table 4.

Table 4:Distribution of fungal isolates in relation to clinical manifestations among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa, Ethiopia, 2014, (n=242)**.**

Fungal species	Clinical Manifestation							Total
	T capitis	T corporis	T cruris	T ungium	T pedis	T faciei	Tmanum	
Trichophyton violacem	(7%)17	(1.65%)4	(0%)0	(7.85%)19	(0.4%)1	(2.5%)6	(0.8%)2	(20.2%)49
Epidermophyton flocosum	(0%)0	(0.8%)2	(0%)0	(0%)0	(0.4%)1	(0.4%)1	(0%)0	(1.65%)4
Candida albicans	(0%)0	(0%)0	(0%)0	(7.4%)18	(0.8%)2	(0%)0	(0%)0	(8.2%)20
Other yeasts	(2.07%)5	(0.4%)1	(0.4%)1	(8.7%)21	(0.4%)1	(1.65%)4	(0%)0	(13.6%)33
Apergillus species	(0%)0	(0.4%)1	(0%)0	(4.5%) 11	(0.4%)1	(0.8%)2	(0%)0	(6.2%)15
Cladosporuimspecies	(0%)0	(1.2%)3	(0%)0	(4.9%)12	(0%)0	(0%)0	(1.2%)3	(7.4%)18
Fusarium	(0%)0	(0%)0	()%)0	(0.8%)2	(0%)0	(0%)0	(0%)0	(0.8%)2
Exophialawernkii	(0.4%)1	(.8%)2	(0.4%)1	(2.9%)7	(0.4%)1	(0.4%)1	(0%)0	(5.4%)13
Alternaria	(0%)0	(0.4%)1	()%)0	(1.2%)3	(0%)0	(0%)0	(0.4%)1	(2.06%)5
Curvularia species	(0%)0	(0%)0	(0%)0	(0%)0	().4%)1	(0%)0	(0%)0	(0.4%)1
Pedrahortae	(0.4%)1	(0%)0	(0%)0	(0%)0	(0%)0	(0%)0	(0%)0	(0.4%)1
Trichophyton Sudanese	(0.4%)1	(0.8%)2	(0%)0	(0.8%)2	(0%)0	(0%)0	(0%)0	(1.65%)4
Pencillium species	(0%)0	(0%)0	(0%)0	(1.65%)4	(0%)0	(0%)0	(0%)0	(1.65%)4
Trichophyton mentagrophyte	(2.06%)5	(0.4%)1	(0.4%)1	(2.9%)7	(1.2%)3	(0.4%)1	(2.07%)5	(9.5%)23
Trichophyton tonsurans	(2.9%)7	(1.65%)4	(0%)0	(3.7%)9	(0%)0	(0%)0	(0%)0	(8.7%)21
Trichophyton rubrum	(1.65%)4	(0.8%)2	(0%)0	(1.65%)4.	(0.4%)1	(0%)0	(0%)0	(4.5%)11
Trichophyton schoeinleini	(1.2%)3.	(1.2%)3	(0%)0	(0.8%)2	(0%)0	(%0)0	(0%)0	(3.3%)8
Trichophyton verrucosum	(0%)0	(0.4%)1	(0%)0	(1.2%)3	(0%)0	(0%)0	(0%)0	(1.65%)4
Microsporum audoini	(0.4%)1	(0%)0	(0%)0	(1.2%)3	(0%)0	(0%)0	(0%)0	(1.65%)4
Microsporum nanum	(0%)0	(0%)0	(0%)0	(0.4%)1	(0%)0	(0%)0	(0%)0	(0.4%)1
Total	(18.6%)45	(11.15%)27	(1.2%)3	(52.9%)128	(4.9%)12	(6.6%)16	(4.5%)11	(100%)242

T=tinea

6.6.Clinical manifestation in relation to age

Different clinical manifestations were observed in almost all age groups. Tinea capitis was the predominant manifestation in age group 1-14 and followed by age group 15-24. Tinea pedis was dominant in age group 45-64 while tinea corporis is the highest in age group 25-44. Tinea ungium was a dominant manifestation in age groups15-64 as indicated in table 5.

Table 5:Distribution of clinical manifestation in different age groups among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa,Ethiopia,2014,(n=305).

age[l] groups	Clinical manifestation							Total
	T[a]capitis	T[a]corporis	T[a]cruris	T[a]ungium	T[a]pedis	T[a]faciei	T[a]manum	
1-14	21	4	0	9	1	0	0	35
	34.4%	12.1%	0.0%	5.8%	6.7%	0.0%	0.0%	11.5%
15-24	14	5	0	42	1	3	0	65
	23.0%	15.2%	0.0%	26.9%	6.7%	15.0%	0.0%	21.3%
25-44	13	16	0	54	5	5	6	99
	21.3%	48.5%	0.0%	34.6%	33.3%	25.0%	37.5%	32.5%
45-64	13	6	2	48	8	12	10	99
	21.3%	18.2%	50.0%	30.8%	53.3%	60.0%	62.5%	32.5%
>=65	0	2	2	3	0	0	0	7
	0.0%	6.1%	50.0%	1.9%	0.0%	0.0%	0.0%	2.3%
Total	61	33	4	156	15	20	16	305
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

T[a] =[l]tinea, Age[l] = WHO age classification for health, 2007.

Table 6: Distribution of fungi in relation to different age groups among patients attending dermatology clinic, at Tikur Anbessa Hospital, Addis Ababa,Ethiopia,2014,(n=242)

fungi species	Age[l]					Total
	1-14	15-24	25-44	45-64	>=65	
Trichophyton violacem	7	12	9	21	0	49
Epidermophyton flocosum	0	0	3	0	1	4
Candida albicans	2	8	6	4	0	20
Other yeasts	2	7	8	15	1	33
Apergillus species	1	1	5	8	0	15
Cladosporium species	1	3	10	4	0	18
Fusarium	0	0	0	2	0	2
Exophialawernkii	2	3	5	3	0	13
Alternaria	1	1	2	1	0	5
CurvulariaSpecies	1	0	0	0	0	1
Pedrahortae	1	0	0	0	0	1
Trichophyton Sudanese	0	0	4	0	1	5
Pencillium species	0	2	1	1	0	4
Trichophyton mentagrophyte	4	4	6	8	1	23
Trichophyton tonsurans	6	5	6	4	0	21
Trichophyton rubrum	1	2	5	3	0	11
Trichophyton schoeinleini	2	5	1	0	0	8
Trichophyton verrucosum	0	2	1	1	0	4
Microsporum audoini	1	2	0	1	0	4
Microsporum nanum	0	0	0	0	1	1
Total	32	57	72	76	5	242

Age[l] = WHO age classification for health, 2007.

7. Discussion

The main objective of the present study was to determine the prevalence of dermatophytes, non-dermatophyte fungi and yeasts collected from skin, nail and hair.

Out of 305 subjects 68.2% were females while 31.8% were males respectively and this is consistent with studies conducted in Nigeria, Ethiopia and Iran, where, 65.9%, 57.3% and 57.7% of the participants were females [4,37,38] respectively. And the mean age in our study was 26 years old similar to a retrospective study in Ethiopia in which the mean age was 27 years old [37].

In the present study, of the 305 study subjects from which skin scrapings, nail scrapings and hair and/or scalp scrapings were collected, fungal species (dermatophytes, non-dermatophyte fungi and yeasts were detected in 166 (54.4%) of clinical samples by direct microscopy and 242(79.4%) clinical samples were culture positive. Sixteen clinical samples that were culture negative, however, were positive by direct microscopy. Detections and isolation rate of dermatophytes reported by earlier study conducted in Ethiopia by collecting specimens from scalps of children in which detection rate in direct microscopy and recovery rate on culture was 74.1% and 73% respectively[15].

Our culture result finding was nearer to the previous two studies in Ethiopia and Kenya which were 73%, 85.2% and 76.1% [15, 37, 39] respectively. The finding of the present study in relation to rate of detection and isolation was entirely in contradiction with the findings of a study in India. Their result indicated that out of 165 clinical specimens collected 100 % were KOH positive while only 110 (67.1%) were culture positive [19]. However, the results of the present study were in good agreement with the finding of a study in Libya. In this study, out of 2224 study population 1180 (53.1%) were KOH positive while 1160 (52.2%) were culture positive [26]. The same holds true with previous study conducted in Ethiopia (15). Though, our result indicated that culture was more sensitive than direct microscopy, we suggest that direct microscopy is still advantageous over culture from the view point of cost, time, in detecting fungi that do not grow on routine common mycological culture media and/ require special culture media.

The present study also depicted that out of 166 fungi identified by direct microscopy dermatophytes accounted 95 (57.3 %) followed by yeasts 37 (18.7%) and non- dermatophyte fungi 16(9.6%) confirmed on culture respectively. Similarly, isolation rate of dermatophyte

was the highest accounting 129 (43.3%) of the total isolates (242) followed by non-dermatophyte moulds 60 (19.7%) and yeasts 53(17.4%) on culture respectively. The pattern and isolation rate of dermatophytes, non-dermatopyte moulds and yeasts obtained in the present study was comparable with those of earlier studies one in Nigeria, three studies in India [4, 19, 40, 41] respectively. A study in India reported that out of 165 cases, dermatophytes were recovered from 48.5% case, etiologic agent of pityriasis versicolor from 39 (23.6%) cases, Candida spp. from 29 (17.1%) cases and etiologic agents of mycetoma from 12 (7.1%) cases [19]. A study involving 100 students was conducted. Out of 100 study subjects 91 (91%) subjects were culture positive of which 53 (58.2%) were dermatophytes. Non-dermatophyte fungi were also recorded in descending order of prevalence were, *A*spergillus *flavus* (9.9%), *Aspergillus niger* (8.8%), *Penicillium* spp. (7.7%), *Candida albicans* (5.5%), *Mucor* spp. (4.4%), *Trichoderma* spp.(3.3%) and *Aspergillus fumigatus* (2.2%)[4]. A study in Libya demonstrated that the major fungi isolated from patients suspected of dermatomycosis were dermatophytes, *Malssezia furfur* and *candida albicans.* In this study, *M. furfur* ranked second in frequency with 27.8% (322 cases) followed by *T. rubrum* 13.8% (160 cases), and *C. albicans* 10% (116 cases) [26]. On the other hand many studies documented that the prevalence of non-dermatophyte molds were greater than dermatophytes [20, 22]. A study showed that **t**he dermatophytes accounted for 5.0% (30/602) of the isolates while non-dermatophyte fungi represent majority of the isolates (15.4%: 93/602). Among the non-dermatophytes, *A. fumigatus* and *C. albicans* were predominat [20]. A study in Egypt documented that non dermatophyte moulds were isolated from 19 cases (59.4 %) of which *Aspergillus* specie*s* being the commonest isolates accounting (47%), and the isolation rate of dermatophytes was (15.6%) followed by yeasts that accounted (9.4%) [22]. The finding of our study was in agreement with the findings of studies in Nigeria and Egypt [20,22] with regards to the pattern of isolation but differed with regards the dominant fungi isolated.

Out of the total isolates in our study *T.violacem* was the predominant dermatophyte (20.25%), followed by *T.mentagrophyte* (9.5%) respectively. This is consistent with previous studies in Kenya and India [21, 27] respectively and another study in Ethiopia reported *T.violacem* constituted 80.6% of the total isolates [15]. However, other studies in Australia and Greece reported *T.rubrum* was the leading followed by *T.mentagrophyte*[33, 35] respectively. In contrast, another study in Poland reported *T.mentgrophyte* was the leading followed by *T.rubrum* [31].

The predominant non-dermatophyte mould was *Cladosporium* species which constituted (7.44%) of the total isolates followed by *Aspergillus* species (6.2%) which is different from most previous studies in Nigeria, Ethiopia and India where *Aspergillus species* followed by *pencillium species* were predominant[4,37,40].In addition; another study in Czech Republic reported *Aspergillus species* and *pencillium species* followed by *Cladosporium species* were predominant (42); but a study in Egypt reported *Alternaria species* followed by *Cladosporium species* were predominant and this author stated that non-dermatophyte moulds may colonize nails that were damaged by occupation related trauma and hence this difference may arise from occupational and hygienic practice of different subjects in different settings that may influence the prevalence of these fungi as *Aspergillus species*, *pencillium species* and *Cladosporium* species are saprophytic fungi that can be found everywhere in soil (43).

The present study revealed that the three predominant clinical manifestations were tinea ungium accounting 156(51.1 %) of which 119 (76.3%) were females and 37(23.7%) were males. This was followed by tinea capitis accounting 61 (20%) of which 37 (60.7%) were females and 24 (39.3%) were males and this was followed by tinea corporis accounting 33(10.8%) of which 26(78.8%) were females and 7(21.2%) were males. Our finding was in good agreement with other findings, in which tinea ungium was the dominant clinical manifestation [18, 35]. On the other hand, tinea capitis was reported as a dominant clinical manifestation by many earlier investigators [20, 21, 29]. Many previous studies also reported tinea corporis [16, 17, 26], tinea cruris [17, 31] and tinea pedis [32] respectively as dominant clinical manifestations.

The predominant clinical manifestations in our study being tinea ungium 51.1%, tinea capitis, 20%, tinea corporis 10.8% respectively were similar to a previous retrospective study in Ethiopia, ; where tinea ungium 56.9%, tinea capitis 22.5%, tinea corporis 3.7% were reported [37] respectively. However; other studies in India, Malaysia and again in India reported tinea corporis followed by tinea cruris were the predominant clinical manifestations [41, 44, 45] respectively. In contrast; in our study tinea cruris and tinea pedis was the least observed site of infection in agreement with a previous study in Ethiopia [37].

In relation to age, the percentage infection of tinea capitis was found out to be higher in age group 1-14 and followed by age group 15-24. Similar results were reported by earlier researches [5, 28]. Tinea pedis was dominant clinical manifestation in age group 45-64. This

goes hand in hand with the findings of a study in Poland [32] while tinea corporis is the highest in age group 25-44. Our result with regards to tinea corporis was not similar to the findings of a study in Libya [26] that reported a prevalence of 45.9% in children below 15 years of age.

The percentage of isolates to the total of culture positive samples in our study in descending order were *T.violacem* 49(20.25%), *T.tonsurans* 21(8.68%), *C.albicans* 20(8.26%), *Cladosporiumspecies* 18(7.44%), *Aspergillus species* 15(6.2%), *E.wernkii* 13(5.37%),*T.rubrun*11(4.55%)*T.schoeinlein* 8(3.3%),*T.Sudanese* 5(2.07%),*Alternaria* 5(2.07%), *E.flocosum* 4(1.65%),*T.vrrucosum* 4(1.65%), *M.audoini* 4(1.65%), *pencilliumspecies* 4(1.65%), *M.nanum* 1(0.41%), *Curvularia species* 1(.41%), *Pedrahortae*1(0.41%) respectively.

T. violacium, *T.tonsurans* and *T. mentagrophytes* as dominant dermatophytes in tinea capitis has been reported by many investigators working in this field of study (15, 19, 21, 24, 27, 46) similar to our finding. The second predominant dermatophyte was *T.mentagrophyte*. Researches out puts have documented *T. mentagrophyte* as dominant dermatophyte [31, 33, 35]. Among non-dermatophytes *Candida* species were the dominant one and a major cause of onychomycosis and this was in agreement with findings from India, Egypt and Iran[47,43,38]respectively.

Tinea capitis was predominant in the age group 1-14 years old children in line with studies in Ethiopia, India and Kenya (15,16,21) respectively. Another study in USA (Baltimore) reported 72% of *T. violaceum* and *T. Sudanese* isolates were cultured from scalp, and the remainder was cultured from skin specimens 24%or nail specimens 4% [46]. But another study in India reported that *Microsporum gypsum* was the predominant agent of tinea capitis [47]. *T.violacem* being an anthropophilic common agent of tinea capitis in Africa [46] is increasing its prevalence, and this wide spread may be due to anthropophilic nature of the fungi. However; another study in Kenya Eldoret town the predominant agent of tinea capitis was *T.tonsurans* 77.8% of the isolates [39].

The predominant etiologic agent of tinea cruris, tinea manum and tinea pedis in our study was *T.mentagrophyte* similar to a study in Iran [48]. Another study in Barcelona reported the predominant agent of tinea pedis was *T.mentagrophyte* [49].

Emergence of more chronic diseases with their debilitating effects resulted from an increase in the old age of world population, the growth of medical science to a point where patients are sustained by drugs, chemicals and mechanical processes that compromise physical barriers to infection, suppress immune mechanisms or upset the balance of normal flora, the association of fungi to HIV/AIDS have rendered hosts more susceptible not only to pathogenic fungi but also to all fungi with which they come in contact partly explains why fungi that were considered non-pathogenic to become pathogens[19]. To this end studying risk factors associated with fungal infection is an active field of research and this will be our research interest in the future.

8. Strengths and limitations of the study

8.1.Strengths

The findings of the study may serve as a baseline data for further study; the study addresses all possible sites of dermatomycosis and potential fungal pathogens of nail, hair and skin infections.

8.2.Limitations

Due to time and financial constraints risk factor for fungal infection and drug susceptibility test were not performed in our study.

9. Conclusion and Recommendations

Conclusion:-The prevalence of fungi that cause different manifestation of dermatomycosis was high, which was found to be 79.3%. Though dermatophytes were the predominat group of fungi, the isolation rate of non-dermatophyte fungi and yeasts were considerable indicating that the spectrums of fungi causing dermatomycosis are diverse. The number of females visiting dermatology clinic with suspected of fungal infection was higher than males and most females were with complaint of tinea ungium. *T.violacem* was the leading pathogen isolated from scalp face and glabrous area of the body followed by *T.mentagrophyte*.

Recommendations:

- We recommend both direct microscopy and at same time fungal culture be encouraged so that patients get the appropriate diagnosis and treatment.
- As our study has indicated the prevalence of fungal infection seems to be very high as compared to other studies and hence we recommend risk factor for fungal infection be studied
- As our study provides baseline information, hence, we recommend further study.

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ANNEXS

Annex I: Sample collection, storage and transportation

Hair	Remove about 10 hairs with roots using forceps; place hairs between clean glass slides or in clean envelope. Wrap slides in paper and tape closed. NOTE: Hairs that break off at scalp level when using forceps must be removed with a knife. Scraping the scalp rarely yields infected hairs. Store and transport at room temperature.
Skin	Wipe lesions well with alcohol sponge (cotton will leave too many fibers on skin). Scrape the entire periphery of the lesion(s) with a sterile scalpel. Place scrapings between two clean glass slides as discussed under hair, or in an envelope. Store and transport at room temperature**.**
Nails	Clean nail with alcohol sponge. Scrape and discard outer portion of nail. Collect scrapings from inner nail and send in envelope or between glass slides. Send an entire nail, if it has been removed, in a sterile screw cap container. Store and transport at room temperature.
Processing	o Nails must be ground in a mortar before inoculated on a culture medium o Skin and hairs can be directly inoculated onto a culture medium

Annex II: Reagent preparation (Stains and Media)

a. 10% POTASSIUM HYDROXIDE

Formula;

Potassium hydroxide (KOH)	10g
Glycerol	20ml
Distilled Water	80 ml

Dissolve the potassium hydroxide in distilled water, and then add glycerol. Mix well. Filter sterilizes. Store in sterile amber bottle. Keep for 3 months.

Purpose: To digest or clear organic material e.g. tissue cells in a specimen in order to allow fungal structures to be more easily demonstrated.

Principle: Fungi are unaffected by KOH. Glycerol prolongs shelf-life by preventing crystallizationand preserves the slides for a few days**.**

Procedure

1. Add a drop of 10% KOH to specimen on slide. Coverslip.

- Gentle heating may aid in dissolving debris
- If specimen is thick, it may take 15-30 minutes to dissolve

2. Observe under low light microscope

b. Lacto Phenol cotton Blue (LPCB)

Formulae: Distilled water	20.0 ml.
Lactic acid	20.0 ml.
Phenol crystals	20.0 g.
Cotton blue	0.05 g.
Glycerol	40.0 ml.

Dissolve phenol in the lactic acid, glycerol, and water by gently heating. Then add aniline blue.

c. Sabouraud Dextrose Agar with Chloramphenicol

Approximate Formula per Liter Purified Water

Pancreatic Digest of Casein.....5.0 g

Peptic Digest of Animal Tissue.....5.0 g

Dextrose.....40.0 g

Agar.....15.0 g

Chloramphenicol.....0.05 g

Storage Instructions: store plates in the dark at 2 – 8°C ready for use.

For slopes: Dispense 10 ml. amounts into UGB bottles.

PRINCIPLES OF THE PROCEDURE

Sabouraud Dextrose Agar is a peptone medium supplemented with dextrose to support the growth of fungi. The peptones are sources of nitrogenous growth factors. Dextrose provides an energy source for the growth of microorganisms. Chloramphenicol is a broad-spectrum antibiotic which is inhibitory to a wide range of gram-negative and gram-positive bacteria.

For slopes: Dispense 10 ml. amounts into UGB bottles. Autoclave 121^{o}C/15 minutes.Store at RT. Final pH 7.0 at 25^{0}C.

d. MYCOSEL AGAR

Purpose

- To isolate pathogenic fungi (especially dermatophytes) from contaminated specimens (it inhibits bacteria and most saprophytic fungi).
- To determine Cycloheximide resistance of fresh isolates as a screening test for pathogenic fungi.

1. Suspend 36 g of the powder in 1 L of purified water. Mix thoroughly.

2. Heat with frequent agitation just until the medium boils, to completely dissolve the powder.

3. Autoclave at 118°C for 15 minutes. Avoid overheating.

4. Test samples of the finished product for performance using stable, typical control cultures.

Slope: Dispense 10 ml. amounts into 25-ml UGB bottles. Autoclave 15 min/ 118^{o}C. Cool on a slant. Store at room temperature.Final pH 6.9 ± 0.2.

Plates: 40 Dispense ml ot each 100x90ml plate

e. POTATO DEXTROSE AGAR (PDA)

Purpose: Sporulation medium for fungi (can also be used in slide culture).

Formulae: Potato dextrose agar 39 g.

Distilled Water 1000 ml. Mix well, bring to a boil to dissolve. Cool to 50^0C.**Slopes:** Dispense 10 ml amounts into pre-sterilized UGB bottles. Autoclave (with loose caps) at 118^0C/10 minutes. Cool in a slanted position. Tighten the caps. Label the bottles "PDA". Store at 40C.

Plates: Mix well, bring to a boil. Cool to 50^0C.Autoclave at121^0C/15 minutes. Cool. Pour plates (label "PDA"). Shrink wrap plates individually. Store at 4^0C

f. GERM TUBE TEST

Purpose: This is a rapid test for the presumptive identification of C. albicans.

Reagents: Bovine serum - A small volume to be used as a working solution may be stored at 2 to 8^oC. Stock solution can be dispensed into small tubes and stored at -20^oC.

Materials: Clean glass microscope slides, Glass cover slips, Glass tubes (13 x 100 mm) & Pasteur pipettes.

Procedure

1. Put 3 drops of serum into a small glass tube.

2. using a Pasteur pipette touch a colony of yeast and gently emulsify it in the serum. The

Pipette can be left in the tube.

3. Incubate at 35^0C to 37^oC for up to 3 hours but no longer.

4. Transfer a drop of the serum to a slide for examination.

5. Cover slip and examine microscopically using x 40 objective

Annex III: English version of participant information sheet, consent/assent

1. **Participant information sheet**

Department of Medical Laboratory Science, Collage of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia

Title: Prevalence of Dermatophytes and Non-Dermatophytes fungal infection Among Patients Visiting Dermatology Clinic,at Tikur Anbessa Hospital, Addis Ababa, Ethiopia.

Introduction

First of all we would like to thank you in advance for your cooperation and consent in participation in this study. Please listen when it is read for you about the general information of the study. If you have any question regarding the study please ask freely.

Background information: Superficial mycoses are among the most frequent forms of human infections, being estimated to affect more than 20-25% of the world's population, and their incidence is constantly increasing particularly in developing nations.

Aim of the study: The objective of this study is to determine the prevalence of dermatophytes and associated fungi implicated in causing various dermatophytosis at Tikur Anbessa hospital Addis Ababa, Ethiopia.

Procedure of the sample collection

Sample will be collected from the specified site after the site is cleaned with 70% alcohol and some part of the specimen collected will be used for investigation to help the physician in managing his patients' treatment protocol and the remaining part of the sample will be used for research purposes after patients or guardian's willingness to participate is confirmed in their signature. The consent agreement will be made by the principal investigator in the laboratory when fungal infection suspected patients come to get KOH direct microscopy test service at Tikur Anbessa hospital laboratory.

Benefits for participants:

Study participants will not have any financial incentives or other inducements from participating on this study. However, their results will be given and will be treated by the prescribing physician based on the KOH mount results and depending on the nature of the disease and the physicians decision; patients may be appointed to await culture results for better treatment.

Risks and complication

There is no considerable risk to the study subjects in participating in the study.

Confidentiality

In order to maintain the confidentiality of participants' information, the name will not be given and the samples will be coded. Participants will not be prohibited to stop or withdraw at any time from the study. Only interested participants can retrieve their own lab result using their code number. The physician will be responsible for the interpretation of the results and providing treatment. No personal identifier will be disclosed to third party or will not appear in any report from this study.

Investigators' contact address

E-mail: gebreab4@gmail.com

Cell phone: +251-912860318

2. Consent form for (ages older than 18 years old)

The objective and the application of the study were briefly explained to me. I am also informed that my demographic and clinical data will be used for this research purpose from the laboratory request form and they will be kept confidential. Moreover, I have been well informed of my right to refuse information, decline to cooperate and drop out of the study if I want and none of my actions will have any bearing at all on my overall health care.

It is therefore with full understanding of the situation that I agreed to give the informed consent voluntarily to the researcher to give my specimen for the mentioned study.

Participant name ----------Signature/fingerprint: ---------- Date ----------

Witness's name---------- signature: ---------- Date ----------

Investigator's name ---------- signature: ---------- date ---------

3. Parental/Guardian Consent Form (for ages less than 11 years old)

I was informed take whatever time I need to discuss the study with my family and friends, or anyone else I wish to. The decision to let my child join, or not to join, is up to me, and will take him/her about 10 minutes ,it is not painful and my child can stop participating at any time and will not lose any benefits as thereof.

As parent or legal guardian, I assure in my signature to become my child a participant in the research study described in this form.

Guardian's name----------Signature/fingerprint: ---------- Date ----------

Witness's name---------- signature: ----------Date ----------

Investigator's name---------- signature: ---------- date ---------

4. Assent form for the age 12-17 years old

The objective and the application of the study were briefly explained to me. I am also informed that all information contained within the laboratory request is to be kept confidential. Moreover, I have been well informed of my right to refuse information, decline to cooperate and drop out of the study if I want and none of my actions will have any bearing at all on my overall health care.

It is therefore with full understanding of the situation that I agreed to give the assent form voluntarily to the researcher to give my specimen for the mentioned study and agreed to use the sample for further study in my signature.

Guardians 'name---------- signature/fingerprint-------date ---------

Participant name---------- Signature: -------- date ---------

Witness's name---------- signature: ---------date ---------

Investigator's name---------- signature: ---------- date ---------

Annex IV. Amharic Version (የአማርኛ ውርስ ትርጉ)

1. □ተሳታፊዎች መረጃ

የህክምና ላብራቶሪ ሳይንስ ክፍል ጤና ሳይንስ ኮሌጅ
የአዲስ አበባዩኒቨርስቲ አዲስ አበባ ኢትዮጲያ

የጥናቱ ርዕስ፡-

በጥቁርአንበሳሆስ□ታልለቆዳ ህክምና □ሚመ□ኑታማሚዎች ላይ በፈንገስ የሚታመሙ ሰዎች ብዛት መስፋፋት አዲስ አበባ ኢትዮጵያ ::

በመጀመሪያበጥናቱ ላይ ለመሳተፍ ፍቃደኛ ስለሆኑልባዊ
ምስጋናዬ አቀርባለው□እባክዎንይህንንየተሳታፊዎች መረጃ
ከልብእንዲያዳምጡበትህትና እንጠይቃለን፡፡□□

ስለጥናቱ ያለዎትን ጥያቄበማንኛውም ጊዜ መጠየቅ ይችላሉ

ስለጥናቱ መረጃ

ዘወትር በፈንገስስለሚጠቁ የሰውነት ክፍሎቻችን ውስጥፀጉር፣ ጥፍር እና ቆዳ ዋነኛቹ ናቸው::

አብዛኛቹ ጥናቶች □ንደሚ□ሳዩትከ 2ወ - 25 ፐርሰንት□ሚሆነውየአለማችንህ□ብ በነዚህ በሽታዎች ይጠቃል፡፡□እነዚህ በሽታዎች በተለይም በማደግ ላይ ባሉ አገሮች በመስፋፋት ላይ □□ኛል::

የጥናቱ አላማ

በጥቁር አንበሳሆስፒታልየቆዳ ህክምና የሚመጡታካሚዎች ላይ በፈንገስ የሚጠቁ ሰዎች ብዛት መስፋት::

የናሙና አሰባሰብ ሂደት

ናሙናየመስ□ትፍቃደኝነትየሚ□ይቅ **ተማራማሪ□** ሲሆን ከተገለፀውን የሰውነትክፍልበ **70 አልኮል** ከ□ዳበህላ ናሙናይወሰዳልናሙናዉሞለሃኪምየሚረዳ፤የሚያገሌ□ል ና የተሳታ□ፍቃደኝነትከተረጋገ□በህላ □ዙረ□□ ንናሙና □□ሞ ለ□ናቱየሚያገሌ□ልይሆናል::

የጥናቱ ተሳታፊዎች ጥቅም

ተሳታፊዎች በጥናቱ በመሳተፍ ምንም አይነት የገንዘብ ጥቅም አያገኙም ነገር ግን ተሳታፊዎች የለሑሃ ምርመራና ውጤት ተቀብለው ተገቢውን ህክምና በሐኪማቸውበኩል □እንደበሽታው ሁኔታና □እንደ ሀኪም ውሳኔ ለተሻለ ህክምና ውጤትጠብቀው□እንዲታከሙ ይደረጋል::

ከጥናቱ ሊመጡ የሚችሉ የጐንዮሽ ጉዳቶች

በዚህ ጥናት የሚሳተ□ ሰዎች ምንም አይነት ጉዳት የማይደርስባቸው መሆኑን □እንገልፃለን ::

የጥናቱ ምስጢራዊነት

□ተሳታፊዎችን መረጃ ምስጢራዊነት ለመጠበቅ ይረዳ ዘንድ የጥናቱ ተሳታፊዎች ስምበጥናቱ ላይ አይገለፅም:: በስምፋንታ መረጃዎቹ በምስጢራዊ ቁጥር/ኮድ/ ይመዘገባሉ::
□እንዲሁም ተሳታፊዎችበፈለጉሰዓት ከጥናቱ መውጣት ይችላሉ:: ፈቃደኛ የሆኑታካሚዎች ለሚሰጣቸው ኮድ ው□ታቸውን ማየት ይችላሉ::

ጥናቱን የሚያካሂደው ሰውማረጋገጫ

ለዚህ ጥናትሃላፊነትን ለመውሰድ ማንኛውም ጥናቱን የሚመለከት ጉዳይ ክትትልለማድረግና ለሚመለከተው አካል መግለጫ ለመስጠትበፊርማዬ አረጋግጣለሁ::

ገብረአብየዝጊ ተክለብርሃን

□ርማ ---------- ቀን ----------

ስል□ መ1286ወ18

2. የፈቃደኝነት ማረጋገጫ ቅፅ/ከ18 አመትእድሜበየላይ ለሆኑ/

ጥናቱ አላማ በጥቁር አንበሳሆስ□ታልለቆዳ ህክምና የሚመጡታካሚዎች ላይ በፈንገስ የሚጠቁ ሰዎች ብዛት ላይ መሆኑ ተነግሮኛል ተ□ል□ልኛል፡፡ ከዚህ ሌላ □ኔ □ምሰ□ዉ መረ□ምስ□ረዊ□እንደሚሆን ተ□ል□ልኛል፡፡ ከጥናቱ በ□ለ□□ መዉጣት□እንደምችልናከጥናቱ በመዉጣቴ ምንም አይነትጉዳት እንደማይደርስብኝ ተገልጾልኛል፡፡

ይህን ከተረዳውበኋላ ለተማራማሪዉ ለመስጠትፈቃደኛነቴን □□ል□ለዉ፡፡

የጥናቱ ተሳታ□ስም---------□ርማ---------ቀን ----------

የአ□ኒዉ ስም----------□ርማ---------ቀን ----------

□መስ□ርስም----------□ርማ------- ቀን ----------

3.የወላጅወይምያሳዳጊፈቃደኝነትቅፅ/ከ11አመትእድሜበታችያሉታዳጊዎችብቻ/

የጥናቱ ርዕስ፡-በጥቁር አንበሳሆስፒታልለቆዳ ህክምና የሚመጡታማሚዎች ላይ በፈንገስ □ሚታመሙ ሰዎች ብዛት አዲስ አበባ ኢትዮጵያ

በዚህጥናትውስጥየእርሶልጅስለተመረጠእባኮዎንስለልጅዎበዚህጥናትየመሳተፍፍቃደኝነትዎንያሳውቁንዘንድእርስዎፍቃደ ኛከሆኑልጅዎከተገለፀውየሰውነትክፍልናሙናእንድንወስድይኸውም
10ደቂቃበላይየማይወስድመሆኑንናህመምየሌለውናእንዲሁምበፈለገውጊዜከጥናቱመውጣትእንደሚችልበመውጣቱምም ንምጉዳትናከህክምናምምንምጉዳትእንደሌለእንገልፃለን፡፡

የአሳዳጊው/ የወላጅ ስም----------□ርማ---------ቀን ---------

የጥናቱተሳታ□ስም----------□ርማ---------ቀን ----------

የአ□ኒዉ ስም----------□ርማ---------ቀን ----------

□ምስ□ርስም----------□ርማ------- ቀን ----------

4. የፈቃደኝነት ማረጋገጫ /ከ12-17 ለሆኑታዳጊዎች/

የጥናቱ አላማ በጥቁር አንበሳሆስፒታል ለቆዳ ህክምና የሚመጡታካሚዎች ላይ በፈንገስ የሚጠቁ ሰዎች ብዛት መስፋፋት ላይ መሆኑ ተነግሮኛል ተ□ል□ልኛል፡፡ ከዚህ ሌላ ከለበራቶሪ መ□የቅ□ምሰ□ው፡የእደሜናየ□ታመረ□ምስ□ረዊ□እንደሚሆንበተ-
ጨማሪ□ተረ□□ ንናሙና ለ□ናቱእንደሚያገሌ□ል ተ□ል□ልኛል፡፡ ከጥናቱ በ□ለ□□ መውጣት□ንእ□ምችል ና ከጥናቱ በመውጣቱ ምንም አይነት □ዳት እንደማይደርስብኝ ተ□ል□ልኛል፡፡

ይህን ከተረዳው በኋላ ለአጥኝው ለመስጠት □ቃ□ኛነቱን □እ□ል□ሰው፡፡

የጥና ቱተሳታ□ስም----------□ርማ----------ቀን ----------

የአሳዳጊው/ የወላጅ ስም----------□ርማ---------- ቀን ----------

የአ□ኒዉ ስም----------□ርማ---------- ቀን ---------

□መስ□ርስም----------□ርማ----------ቀን ----------

Annex V. Demographic and clinical data record format

Addis Ababa University Collage of Health Sciences Department of Medical Laboratory Science demographic and record format for the prevalence of dermatophytes and non-dermatophyte fungi among patients visiting dermatology clinic, at Tikur Anbessa hospital Addis Ababa, Ethiopia.

i. Sample ID------- ,Age ----------

ii. Sex:

1	male	2	female

iii. Site of infection (clinical manifestations):

1	scalp (T. capitis	4	nails (Onychomycosis)	7	T. manuum
2	trunk (T. corporis)	5	feet (T. pedis)	8	P. versicolor
3	groins (T. cruris)	6	Face (T. faciei)	9	others----------

Microscopic (KOH) lab result:

1	Fungal element seen	2	No fungal element seen

Culture result----------

Annex VI. Declaration

I the undersigned, declare that this is my original work and has not been presented for a degree in this or any other university and all sources of materials used for this thesis have been acknowledged.

Name: Gebreabiezgi Teklebirhan Gessew

Signature _____

Place:Addis Ababa University,Tikur Anbessa Hospital.

Date of submission: June, 2014

This thesis has been submitted with my approval as University advisor.

Name: AdaneBitew(MSc, PhD, Associate Professor of Microbiology)

Signature _____

Place: Addis Ababa University, CHS, School Of Medical Laboratory Science.

Date of resubmission: June, 2014