Mycological study on skin diseases in Taiz City, Yemen

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Abstract
In this study, the dermatophytic infections in patients referred to Department of Dermatology, AL-Gotham Hospital, Taiz, during May 2013 to May 2014 were examined. The direct microscopic examination was positive in 67.3 % of the cases. Tinea capitis was the commonest fungal disease (48 cases out of 150) followed by tinea versicolor (46) and tinea corporis (38). Males were more affected by these diseases than females. The majority of tinea capitis (85.42%) and tinea corporis (47.4%) was in the age group of 1 to 15 years. Culturing of specimens yielded 10 fungal species and the common dermatophytes were *Trichophyton violaceum* and *Microsporum canis*. *Candida* spp. (including *C. albicans*) were associated with 46.2% of tinea pedis. The prevalence of various superficial mycotic infections in this study seemed to be associated with socioeconomic, sanitary and hygienic conditions in Taiz that are generally poor and substandard.

Keywords: Dermatophytes, fungal infection, Tinea, Yemen.

Introduction
Superficial mycoses are infections of skins, hairs and nails caused by dermatophytes, yeast and non-dermatophytes molds (Seebacher et al., 2008; Miklic et al., 2010). Dermatophytes are fungal agents of dermatophytosis and named after anatomic localization of lesions (Behzadi et al., 2014; Sharma et al., 2016). Dermatophytes including 3 genera; *Trichophyton*, *Microsporum* and *Epidermophyton* (Weitzman & Summerbell, 1995).

According to their habitats, these fungi are classified into anthropophilic, zoophilic and geophilic. Geophilic fungi grow on keratin present in the soil and derived from human and/or animal keratin of its debris. Zoophilic fungi are parasites of animal keratin, and anthropophilic fungi digest human keratin (Gupta et al., 2003; Sageeraban et al., 2011; Chaudhary and Kumar, 2016).

*Malassezia* and *Candida* spp. are among the yeasts that cause skin infections. *Malassezia* spp., the agents of superficial mycosis, are strictly lipophilic and parts of the normal microbiota of the skin and scalp (Ruiz and Zaitz, 2001; Zeinali et al., 2014). Although without keratinolytic activity, these species live on the skin around the hair and use epithelial debris or waste products as energy sources for development (Oliveira et al., 2006; Chiacchio et al., 2014).

Many studies on superficial mycoses in different parts of the world have confirmed that host susceptibility may be enhanced by moisture, warmth, specific skin chemistry composition of sebum and perspiration, age, heavy expourem genetic predisposition, use antimicrobial, Immunosuppressive drugs as well as the emergence of AIDS, has been reported as predisposing factors of the increased incidence of dermatophytoses
In Taiz City, there were no studies dealing with the occurrence, incidence or prevalence of dermatophytosis among population. Thus, this study was designed to determine the diversity of dermatophytes responsible for different types of tinea, the nature of the etiological agents according to age and gender in patients visiting the dermatology clinic in Taiz city.

Materials and Methods

Collection of samples:
150 samples of skin scrapings and hair roots from patients clinically suspected for skin and hair infections, which were attending to Dermatology and Venereology outpatient clinic at AL-Gotham hospital were collected during the period from May 2013 to May 2014. The infected area were thoroughly cleaned with 70% ethanol cotton swabs to remove dirt and contaminants, then after drying, skin scrapings were collected from the active edge of the lesions with sterilized scalpel blade. In Tinea capitis, a scalpel may be used to scrape scales and excavate small portions of the hair root. The samples were transferred to the Mycological Laboratory, Microbiology Department, Faculty of Science, Taiz University, for fungal analysis as following:

1- Direct Microscopic Examination:
The samples were treated with an aqueous solution of 10 % potassium hydroxide (KOH) and examined under microscope to see mycelium and/or arthrospores in skin scales (Panasiti et al., 2006) or either ectothrix or endothrix infection of hair (Ayaya et al., 2001).

2- Culturing and isolation of the causal agents:
A portion of each sample was also cultured on Sabouraud dextrose agar supplemented with chloramphenicol (0.5 mg/ml) and cycloheximide (0.5 mg/ml) to prevent the growth of bacteria and fast-growing fungi respectively. All cultures were incubated at 28°C for up to four weeks.

3- Identification of the causal agents:
Identification was based on macroscopic and microscopic examination of culture isolates. The microscopic examination of fungal growth was observed with lactophenol cotton blue stain. Nature of mycelium and conidia formation (macro- and microconidia) helped to differentiate various genera and species. Fungi were identified according to the keys of Kwon- Chung and Bennett (1992); Milne (1996); Collee et al. (1996); Kane et al. (1997); Irene and Richard (1998); De Hoog et al. (2002) and Burns et al. (2010).

Budding yeast cells of Candida spp. were identified microscopically. Candida species were classified as albicans and non-albicans group by the production of chlamydospores on corn meal agar and germ tube formation. Malassezia spp. were identified using direct microscopic examination.

Results:
In the current study, the total number of examined patients was 150, of which, 86 were males (57.3%) and 64 were females (42.7%), aged 1-60 years old. There are 59 (39.3%) patients aged 1-15 years, 19 (12.7%) aged 16-30 years, 45 (30%) aged 31-45 years and 27 (18%) aged 46-60 year (Table 1).

Among patients, Tinea capitis (32%) was the predominant clinical followed by tinea versicolor (30.7 %), Tinea corporis (25.3%), tinea pedis (8.7%), and tinea cruris (3.3%). The direct microscopic examination of skin and hair samples showed fungal elements (hyphae, spores or yeast cells) in 67.3% of total cases (Table 1).
Table (1): Distribution of skin mycotic diseases in Taiz city according to sex, age, number and percentage of positive cases shown by direct microscopic examination.

<table>
<thead>
<tr>
<th>Clinical diagnosis of diseases</th>
<th>No. of cases</th>
<th>%</th>
<th>Sex</th>
<th>Age group by years</th>
<th>Direct microscopic examination</th>
<th>% of +ve cases</th>
<th>% of all cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>male</td>
<td>female</td>
<td>1-15</td>
<td>16-30</td>
<td>31-45</td>
</tr>
<tr>
<td>Tinea capitis</td>
<td>48</td>
<td>32.0</td>
<td>26</td>
<td>54.2</td>
<td>22</td>
<td>45.8</td>
<td>41</td>
</tr>
<tr>
<td>Tinea versicolor</td>
<td>46</td>
<td>30.7</td>
<td>30</td>
<td>65.2</td>
<td>16</td>
<td>34.8</td>
<td>-</td>
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<tr>
<td>Tinea corporis</td>
<td>38</td>
<td>25.3</td>
<td>21</td>
<td>55.3</td>
<td>17</td>
<td>44.7</td>
<td>18</td>
</tr>
<tr>
<td>Tinea pedis</td>
<td>13</td>
<td>8.7</td>
<td>5</td>
<td>38.5</td>
<td>8</td>
<td>61.5</td>
<td>-</td>
</tr>
<tr>
<td>Tinea cruris</td>
<td>5</td>
<td>3.3</td>
<td>4</td>
<td>80.0</td>
<td>1</td>
<td>20</td>
<td>-</td>
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<tr>
<td>Total No. of cases</td>
<td>150</td>
<td></td>
<td>86</td>
<td>57.3</td>
<td>64</td>
<td>42.7</td>
<td>59</td>
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<table>
<thead>
<tr>
<th>Organisms</th>
<th>Tinea capitis</th>
<th>Tinea corporis</th>
<th>Tinea cruris</th>
<th>Tinea pedis</th>
<th>Total cases</th>
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<td>I</td>
<td>%</td>
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<tr>
<td>Epidermophyton floccosum</td>
<td>-</td>
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<td>2</td>
<td>5.3</td>
<td>4</td>
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<td>Langeron &amp; Milochevitach</td>
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<tr>
<td>Microsporum canis Bodin</td>
<td>10</td>
<td>20.8</td>
<td>12</td>
<td>31.6</td>
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<tr>
<td>M. gypseum (Bodin)</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>5.3</td>
<td>-</td>
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<tr>
<td>Trichophyton mentagrophytes</td>
<td>-</td>
<td>3</td>
<td>7.8</td>
<td>-</td>
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<tr>
<td>(Robin)Blanchard</td>
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<tr>
<td>T. rubrum (Castellani) Semon</td>
<td>3</td>
<td>6.3</td>
<td>1</td>
<td>2.6</td>
<td>1</td>
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<tr>
<td>T. verrucosum Bodin</td>
<td>2</td>
<td>4.2</td>
<td>5</td>
<td>13.2</td>
<td>-</td>
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<tr>
<td>T. violaceum Sabouraud</td>
<td>33</td>
<td>68.7</td>
<td>13</td>
<td>34.2</td>
<td>-</td>
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<tr>
<td>Fusarium solani (Martins) Saccardo</td>
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<td>-</td>
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<td>3</td>
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<tr>
<td>Geotrichum candidum Link</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Candida albicans (Robin)Berkhout</td>
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<tr>
<td>Candida spp.</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>Number of species</td>
<td>4</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>10</td>
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</tbody>
</table>

Table (2): Incidence (I) and percentage incidence (I%) of fungi in the different mycotic diseases.

Discussion:
Dermatophytosis cannot be easily diagnosed on the basis of clinical manifestations as a number of other conditions mimic the clinical presentation (Richardson and Warnock, 2003). The etiology and frequency of dermatomycoses vary with changes in geographic and climatic conditions, different living habits and life style (Kantarcıoğlu et al., 2015).

In this study, superficial fungal infections were more frequently in males than females (57.3% versus 42.7%). Our findings are in agreement with studies of dermatophytosis in Iran (Falahati et al., 2003), and India (Kumaran and Jeya, 2014). Moreover, there are many studies showed higher infection...
among males such as: Hitendra et al. (2012); Murtaza et al. (2013); Hashemi et al. (2014); Jain et al. (2014). On the other hand several investigation showed more infections among females than males (Abanmi et al., 2008; Silveira – Gomes et al., 2013; Chiaccchio et al., 2014).The reason for these variations is not fully understood, but it indicates that gender may influence susceptibility to particular form of tinea (Aghamirian and Ghiasian, 2007; Allaham et al., 2011).

According to the current results, the incidence of superficial fungal infections caused by dermatophytes was more frequently seen in children aged 1-15 years than in other age groups. Many studies are in agreement with our finding (Ramakrishnaiah et al., 2014; Mayorga et al., 2016). Tinea capitis was the main clinical type encountered and accounted 32% of all infections, more prevalent in males (54.2%) than in females (45.8 %) and its highest prevalence was in children before the age of 15 year. This is in accordance with studies of Shukla et al. (2013); Thakur (2013) and Adel et al. (2014). The reason for this has been mainly endorsed to sensitivity of dermatophytes to certain fatty acids secreted from sebaceous glands that appear at puberty. The higher incidence rate observed in adult postmenopausal women is due to hormonal changes which result in a reduction of sebaceous secretions (Frangoulis et al., 2005).

In Taiz city, the large family size, contact with infected animals and infected children, and sharing of towels, clothing and hair accessories may lead to spread of dermatophytes.

In this survey the anthropophilic T. violaceum was reported to be the main causative organism of tinea capitis (68.7%) and was the major etiologic agent of tinea corporis (34.2%). In this respect, T. violaceum has been detected as the most prevalent species of dermatophytic infections in several Asian countries, including Saudi Arabia (Venugopal and Venugopal, 1992), Iran (Lari et al., 2005; Jahromi and Khaksar, 2006), Nepal (Jha et al., 2006), Pakistan (Ansari & and Siddiqui 2006) as well as in African countries such as Libya (Ellabib, et al. 2002), Kenya ( Chepchirchir et al., 2009) and Egypt (Amer et al., 2014). Sporadic cases of T. violaceum infection are reported in America (Magill et al., 2007), Australia (Marleu and Andrew, 1997), Europe (Valari et al., 2012).

M. canis was the second common causal agent of tinea corporis (31.6%) and tinea capitis (20.8%). M. canis was the most commonly isolated dermatophyte species recorded in Kuwait (Adel et al., 2007), Iraq (Al-Hmadani et al., 2014), Palestine (El-Khair, 2014), Italy (Cervetti et al., 2014), Saudi Arabia (Alseikh, 2009), Egypt (Azab et al., 2012) and Nigeria (Ndako et al., 2012). The incidence of M. canis infection in our study had recorded from patients with histories of animal contact. Such result confirm the scientific fact that the M. canis is a zoophilic fungus (Cafarchia et al., 2011; Mohammed, 2013; Yin et al., 2013).

Tinea versicolor was recorded in 46 cases, of which 30 were males (65.2%) and 16 were females (34.8%). Similar finding was recorded in previous studies (Rahman et al., 2011; Zeinali et al., 2014). In this study, most cases of Malassezia spp. infection occurred in age group 31-45 year. A possible explanation is that, because of the lipophilic nature of this yeast and post-puberty hormonal stimulus inherent in this age group, there is stimulation of sebaceous glands accompanied by an increase in fat content of skin, which serves as an asbstrate for the fungus. These results are in agreement with those reported in the literature (Furtado et al. 1997; Oliveria et al. 2002; Chiaccchio et al. 2014).

Tinea pedis was more frequently in females over 45 years (76.9%) and Candida spp. was often the most associated with these cases. This finding concurred with those of the results of Abbas, et al. (2012), Elfekih et al. (2012) and Manjula and Parameswari (2016).

Tinea cruris was found in 5 cases, Epidermophyton floccosum was isolated in 4 cases and T. rubrum in one case. E. floccosum was reported as the main causal agent of tinea cruris in Egypt (Moubasher et al., 1993); Iran (Shahindokht and Khaksari, 2009) and Saudi Arabia (Alseikh, 2009).

Conclusion:

The spectrum of various fungi causing skin mycosis has not been documented from Taiz
City. Therefore, the present study was undertaken to describe the prevalence and distribution of various fungal isolates causing skin mycosis. Tinea capitis was the most common dermatophytosis followed by tinea corporis. They were mainly caused by the anthropophilic T. violaceum. The zoophilic dermatophyte M. canis ranks next in frequency, which reflects the degree of contact between the human and animal populations. The geophilic dermatophyte M. gypseum was isolated from clinical specimens, confirming the frequent contact with environment.

The present study provides data that are valuable for determination of superficial mycoses among the population in Taiz city. These data provide a preliminary assessment of the prevalence and etiological profiling of the infections. This could help in the estimation of the problem more accurately in the future and thence in the prevention of spread of superficial mycoses. Moreover, awareness of the preventive measures regarding public health and maintenance of personal hygiene could reduce the incidence of these mycoses.

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