Prevalence and causative agents of superficial mycoses in a textile factory in Adana, Turkey

Pra¨valenz und Erregerspektrum von Hautmykosen in einer Textilfabrik in Adana, Türkei

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Summary

This study was carried out in a textile factory settled in the city center of Adana, Turkey. The workers were evaluated for the presence of superficial mycoses and the interaction of their working environment or working condition. A total of 431 textile workers were included in the study, with a male to female ratio of 378 (87.7%) to 53 (12.3%) and an age range of 19–52 (mean: 33.7 ± 6.8). Direct examination and/or culture revealed superficial mycoses in 73 (16.9%) workers, among them 56 (76.7%) were classified as dermatophytoses, 8 (11.0%) as Pityriasis versicolor while in nine (12.3%) of the cases, no causative agent could be determined. Trichophyton rubrum (57.1%) and T. mentagrophytes (42.9%) were the two species isolated on culture. This study emphasized that textile workers should be admitted as a risk group for superficial mycoses, especially tinea pedis.

Zusammenfassung


Key words: Trichophyton rubrum, Trichophyton mentagrophytes, dermatomycosis, pityriasis versicolor, epidemiology, Turkey.

Schlüsselwörter: Trichophyton rubrum, Trichophyton mentagrophytes, Dermatomykosen, Pityriasis versicolor, Epidemiologie, Türkei.

Introduction

Superficial fungal infections consist of dermatophytosis, candidosis, pityriasis versicolor (PV), tinea nigra, and white and black piedra. The prevalence of these diseases are affected by age, gender, social activities, socio-economic conditions, geographic location and also population dynamics such as tourism, work and life.1,2

Working conditions can affect the human health in various ways. Textile industries are involved in the production of cotton–wool yarn in which certain environmental conditions such as heat and humidity for correct yarn spin and weaving (e.g. a temperature of 28–29 °C and a humidity of 70–80%) are essential. The environmental temperature should be around 17 °C in
work-places for the workers’ thermal comfort. Textile work-places require humidity and also a temperature higher than 17 °C, with consequent health problems because of water and salt loss. Excess sweating and increase in body temperature lead to various skin diseases such as superficial fungal infections.3

The aim of the present study was to determine the prevalence and causative agents of superficial fungal infections in a textile factory.

Materials and methods

Totally, 431 workers of a textile factory in Adana, a city in the east Mediterranean coast of Turkey, were scanned for superficial fungal diseases in the period between July 1999 and September 1999. The workers participating in the study were first interviewed and then asked to fill in a questionnaire form on complaints related to scalp, skin and/or nails. Thereafter, they were examined for the possible presence of lesions on the skin and/or its appendages.

Grouping workers

Working environment was divided into four groups different in the degree of risk for superficial mycoses, such as temperature, humidity, aeration, high-topped rubber boots, contact with water, etc.

Group I: Sections of quality control and planning, dining hall, stores (temperature: 28–30 °C, humidity: 15–20%),

Group II: Rooms of staff, security, and administration (temperature: 28–30 °C, humidity: 15–20%),

Group III: Sections of electricity and machine energy; dyehouse, section of yarn dying, fabric laboratory (temperature: 30–35 °C, humidity: 40–45%),

Group IV: Sections of yarn weaving, bobbin and bobbin-spinning (temperature: 28–30 °C, humidity: 70–80%).

Mycological examination

The specimens of skin and nail scrapings were aseptically collected into presterilized paper packets after cleaning the lesions with 70% alcohol. A portion of each clinical specimen was mounted in 15% potassium hydroxide solution and examined microscopically for the presence of fungal structures. The remainder of each specimen was inoculated on agar slants of Sabouraud glucose agar (SGA, Difco, Detroit, MI, USA), potato dextrose agar (PDA, Difco), and mycobiotic agar (MBA, Difco). Cultures were incubated at 26 °C for 4 weeks before being discarded as negative. Fungal isolates, if any, were then subcultured on SGA and PDA in Petri dishes. The growing mold colonies were identified with classical methods. Cases of PV were diagnosed on the basis of microscopical demonstration of the characteristic ‘meatballs and spaghetti’ pattern of the respective yeast and hyphal forms of Malassezia furfur in skin scrapings.4

Results

The mean ages of 378 (87.7%) male and 53 (12.3%) female workers were found to be 34.3 ± 6.6 and 29.4 ± 6.8, respectively, with a total of 431 workers with mean age of 33.7 ± 6.8 (range 19–52).

After investigation and direct examination, 73 (16.9%) of 152 workers’ samples that underwent direct microscopy and culture revealed superficial mycosis. Among these workers, 56 (76.7%) were classified as dermatophytosis, eight (11.0%) as PV, while in nine (12.3%) of the cases no causative agent could be isolated. Cases showed no statistically significant difference of superficial mycoses distribution for gender (P = 0.6, Table 1).

Of the 73 workers with superficial mycoses, the mean age of male patients was 36.5 ± 7.9, male to female ratio was 66 (90.4%) the mean age for females 35.8 ± 6.4–7 (9.6%). The mean age of 358 workers with no superficial mycosis was 36.5 ± 5.6. The mean ages were not statistically significant according to gender or superficial mycoses situation (P > 0.05).

Mycological investigation revealed 32 positive samples for both direct microscopy (DM) and culture, 24 samples negative in DM but positive in culture, nine samples positive in DM but negative in culture, and 87 samples negative in both. Statistical examination between culture and DM culture revealed significant difference (P < 0.000001, Table 2).

Table 1 Gender distribution of cases examined for superficial mycosis.

<table>
<thead>
<tr>
<th>Superficial mycosis situation</th>
<th>Gender</th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>%*</td>
</tr>
<tr>
<td>Mycosis (+)</td>
<td>66</td>
<td>7</td>
<td>73</td>
<td>9.6</td>
</tr>
<tr>
<td>Mycosis (-)</td>
<td>312</td>
<td>46</td>
<td>358</td>
<td>12.8</td>
</tr>
<tr>
<td>Total*</td>
<td>378</td>
<td>53</td>
<td>431</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Line% x² = 0.3, d.f. = 1, P > 0.05.

†Column%.
Causative fungi were defined at the level of genus and species in 64 (87.7%) of 73 workers with superficial mycoses. The distribution of mycoses were as follows: 45 (70.3%) cases of tinea pedis, eight (12.5%) PV, seven (10.9%) tinea unguium, two (3.1%) tinea inguinalis, one (1.6%) tinea manuum and one (1.6%) tinea corporis. In nine workers (12.3%) DM was positive, but culture was negative. *Trichophyton rubrum* was detected in 32 (57.1%) of 56 cases and *T. mentagrophytes* in 24 (42.9%) (Table 3).

When the working place and frequency of superficial mycoses were evaluated, the frequency of infection was 13.6% (11 cases) in Group I, 27.3% (six cases) in Group II, 16.9% (20 cases) in Group III, and 17.1% (36 cases) in Group IV. No significant difference was found between groups (*P* = 0.5, Table 4).

### Discussion

Superficial mycoses was determined in 73 (16.9%) of 431 textile workers with a distribution of dermatophytes in 56 (76.7%), PV in eight (11.0%), and positive DM-negative culture in nine (12.3%). Studies carried out in Adana in different communities in the same period of time revealed that the prevalence of superficial mycoses ranged from 1.5 to 2.6%.5,6 The prevalence of 16.9% found in this study shows that superficial mycosis is frequent among textile workers in our area as it is in other work-places.3,7 Dermatophytosis is found to be the most frequent superficial infection in the workers. This situation can be explained by the dense working force leading to close contact among workers, by the contagious nature of dermatophytes, and by higher frequency of dermatophytoses in males. The prevalence of dermatomycoses has been clinically and/or mycologically investigated in different branches of industry since Gentles and Holmes 8 had reported the higher prevalence of foot dermatomycoses among miners.

*Palalı et al.*9 in their study in a car-factory in Turkey, suspected of superficial mycoses in 414 (38.0%) of 1089 workers, but their examinations showed positive DM in 188 (45.4%) and positive culture in 130 (31.4%). The causative agents found, in the order of frequency,

### Table 2

Mycological investigation results of 152 workers with suspect of superficial mycosis.

<table>
<thead>
<tr>
<th>Mycological investigation</th>
<th>Direct microscopy (+)</th>
<th>Direct microscopy (-)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%*</td>
<td>Number</td>
</tr>
<tr>
<td>Culture (+)‡</td>
<td>32</td>
<td>57.1</td>
<td>24</td>
</tr>
<tr>
<td>Culture (–)</td>
<td>9</td>
<td>9.4</td>
<td>87</td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>27.0</td>
<td>111</td>
</tr>
</tbody>
</table>

*Line% x² = 38.6, d.f. = 1, P < 0.000001.
†Column%.
‡Pityriasis versicolor (PV) cases were classified as culture (+) when they were DM (+). According to general approach and application. Other statistical levels of the table are the same for diagnosis other than PV.

### Table 3

Lesion distribution and mycological investigation results other than pityriasis versicolor.

<table>
<thead>
<tr>
<th>Culture positive</th>
<th>Culture negative, microscopy positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td><strong>T. rubrum</strong></td>
<td><strong>T. mentagrophytes</strong></td>
</tr>
<tr>
<td>Back</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Arms</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Groin</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Toe web</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>Toe nail</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>32</td>
<td>24</td>
</tr>
</tbody>
</table>

### Table 4

Distribution of superficial mycoses in different departments.

<table>
<thead>
<tr>
<th>Departments</th>
<th>Superficial mycosis (+)</th>
<th>Superficial mycosis (–)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%*</td>
<td>Number</td>
</tr>
<tr>
<td>Group I</td>
<td>11</td>
<td>13.6</td>
<td>70</td>
</tr>
<tr>
<td>Group II</td>
<td>6</td>
<td>27.3</td>
<td>16</td>
</tr>
<tr>
<td>Group III‡</td>
<td>20</td>
<td>16.9</td>
<td>98</td>
</tr>
<tr>
<td>Group IV</td>
<td>36</td>
<td>17.1</td>
<td>174</td>
</tr>
<tr>
<td><strong>Total</strong>*</td>
<td>73</td>
<td>16.9</td>
<td>358</td>
</tr>
</tbody>
</table>

*Line% x² = 2.3, d.f. = 3, P > 0.05.
†Column%.
‡Group III workers were found to wear high-topped rubber boots and to share a common shower.
were T. mentagrophytes (38.5%), Candida spp. (25.4%), T. rubrum (13.8%), Epidermophyton floccosum (9.2%), T. violaceum (6.9%) and T. tonsurans (6.2%). Akpata et al. in Nigeria examined 194 workers in rubber, wood and cement factories and recorded 54 (27.8%) cases of dermatomycoses by direct examination and/or culture; they found no statistical difference between factory groups. The frequency of mycoses was as follows: PV (70.4%), tinea pedis (14.8%), tinea corporis (7.4%), onychomycoses (3.7%), tinea cruris (1.9%), and tinea capitis (1.9%).

Bozkurt et al. examined clinically 525 workers in a textile factory finding tinea pedis in 177 (33.7%), onychomycoses in 26 (4.9%), tinea pedis and onychomycoses in 95 (18.1%), tinea manuum in three (0.6%), tinea corporis in three (0.6%), tinea cruris in three (0.6%), PV in 17 (3.2%) with a total of superficial mycoses in 324 (61.7%).

Epidemiological information on dermatophytoses and determination of genera and species of causative agents are essential from the view point of infection control and public health. The etiological agent may be zoophilic or anthropophilic, may cause outbreaks in crowded institutions like schools or dormitories or may lead to rapidly progressing outbreaks in the community. Anthropophilic T. rubrum has been found to be the most prominent cause of glabrous skin and nail dermatophytoses. In the past, the most frequent agents of tinea pedis and tinea unguium were T. mentagrophytes and E. floccosum, respectively, but at the present time T. rubrum has taken the lead in both infections and also in tinea unguium.

In this study, the most frequently isolated species were T. rubrum and T. mentagrophytes for glabrous skin and nail dermatophytoses. The same frequency was observed in tinea glabrosa cases in and around the city of Adana. The leadership of T. rubrum in dermatophytic flora can be explained by extensive distribution of the agent world-wide, by its being the cause of chronic infections, and by its resistance to treatment.

Although PV is reported world-wide, it is more frequently observed in hot summer months and humid tropical regions. While 20–50% of the population are infected in tropical regions, the prevalence of PV is calculated to be around 1% in Northern America and Europe. The prevalence of PV is around 2–3% in Turkey while it has been found to be between 0 and 3.5% in the healthy population in and around Adana and 1.5% among soldiers at compulsory military service. Our final result of 2% in this study is consistent with the studies mentioned above. The localization of the lesion was mainly in the trunk, being consistent with other studies citing the distribution.

The factory administrators, factory physician and workers were informed on the predisposing factors for superficial mycoses and relevant preventive measures. The workers with dermatomycoses were treated with appropriate antifungals.

References


