

# Epidemiology of Onychomycosis in Gujranwala Division-Pakistan

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## Abstract

Onychomycosis is a common fungal infection of nails. It is usually further divided into four types which are Distal and lateral subungual onychomycosis (DLSO), white superficial onychomycosis (WSO), proximal subungual onychomycosis (PSO) and candidal onychomycosis (CO). The main causative agents of onychomycosis are three fungal forms: dermatophytes, yeasts, and non-dermatophytes molds. In current study, occurrence frequency of various types of onychomycosis was observed in a selected region of Pakistan. Collected data were statistically analyzed at 0.001% significance level by using single factor ANOVA for comparative examination on the basis of gender, age and onychomycosis types. Results indicated that males suffer more than females, adults are more prone to get onychomycosis attack and DLSO is frequently occurring than other forms. The root causes of this epidemiological trend were lack of personal hygiene and health care awareness among masses and knowledge about symptoms and effects of onychomycosis meanwhile poverty was also found as a leading indirect reason for the spread of this nail disorder. Future researchers should find out cost effect local alternatives for treatment and control of onychomycosis along with some general public awareness program.

**Keywords:** Onychomycosis; fungal infection; dermatophytes; yeasts; non-dermatophytes molds; nail disorder; personal hygiene.

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## 1. Introduction

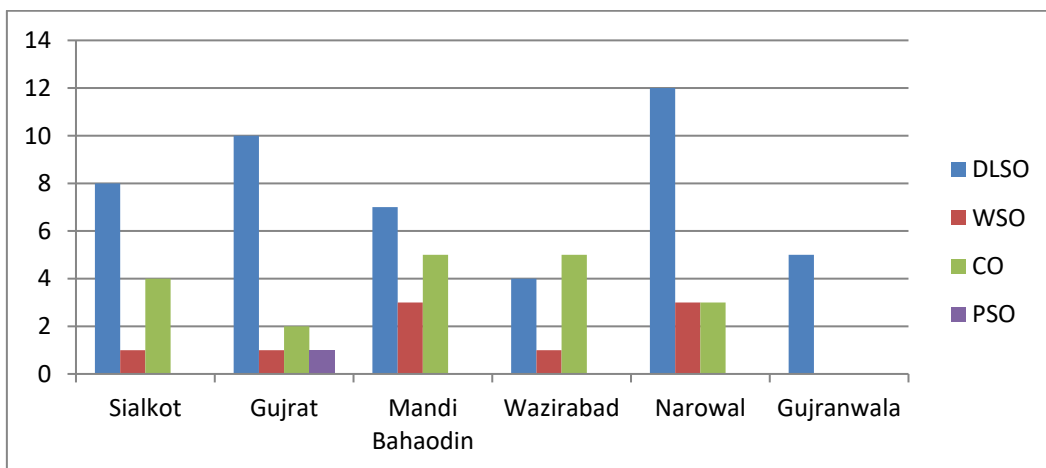
Onychomycosis (from the Greek “onychos” means nail and “mycosis” means fungal infection [1] ) is a global issue of fungal attack on nail that gradually leads to damaging changes of the nail plate and nail bed, as well as onycholysis, subungual debris, discoloration, and thickening [2-3]. Clinically onychomycosis is usually classified as: distal/lateral subungual onychomycosis, white superficial onychomycosis, proximal subungual onychomycosis and candida onychomycosis [4-8]. From clinical point of view, most frequently found type is Distal and lateral subungual onychomycosis (DLSO) which is characterized by the distribution of dermatophytes in the skin of soles and palms, in general connected with tinea pedis [9-10]. It appears as onycholysis, discoloration, subungual hyperkeratosis and thickening damaging the distal/lateral nail. White superficial onychomycosis (WSO) is pale spots on or in the nail plate with textural changes [11]. In patients with proximal subungual onychomycosis (PSO), the fungal mycelium grows deeper become visible in the lower layers of the nail and are more commonly found in immunocompromised patients [10]. It appears as discoloration and onycholysis on proximal regions of the affected nail. Candidal onychomycosis (CO) is characterized by particularly thickened and roughened nail plates [11]. It is usually less reported in fingernails than toenails. But for this type of onychomycosis, most frequently reported causative *Candida* species are *C. albicans* and *C. parapsilosis* [9-10, 12-13]. The onychomycosis is caused by three types of fungi: dermatophytes, yeasts, and non-dermatophyte molds (NDM) [6-7, 9, 14-16]. According to the organization for Human and Animal Mycology, typical onychomycosis is mainly caused by dermatophytes, if it is specifically caused by yeasts which is less common then it is termed as onyxis; similarly, if the causative pathogen is *Candida*, this type of nail infection is called nail candidiasis, and in case of other opportunistic fungal attack on nails, the infection is recognized as nail mycosis [1]. A number of the well-documented risk factors for onychomycosis are growing age, injured nail, obesity, shoes having fungal spores or growing mycelium, onychomycosis as family disorder, smoking, other conditions like diabetes, immunodeficiency or peripheral arterial disease, and professional activities and such pursuits which may serve as potent source for onset of nails' fungal infections [17-18]. Frequent occurrence of the infection also depends upon the geographic area, population, and mycological facial appearance or diagnostic methods employed [19]. Onychomycosis is reported to be extra ordinary amongst men than women in different regions of the world [20]. Onychomycosis comprises of 33% of the entire skin fungal infections and 50% of entirely nail disorders. More than 90% of onychomycosis are due to dermatophytes, as well as *Trichophyton rubrum* and *Trichophyton mentagrophytes* and the remnants by sculpt non-dermatophytes (*Scopulariopsis*, *Aspergillus*, *Fusarium*, *Penicillium* and *Scytalidium* species) and yeasts (*Candida albicans*) [9,21-26]. In short, this fungal disorder is potent source of major skin and nails damage and itself provides an appropriate environment for the proliferation of microorganisms which are considered vital to enhance prevalence of infection, necrosis and diabetic foot. Therefore, the determination of its frequency, appropriate diagnosis and control may reduce the considerable number of its sufferers [27]. The purpose of current study is to explore, how frequently onychomycosis occurs in Gujranwala division, which type is more frequent, which gender and age group are suffering more and in future which preventive measures should be taken to avoid and cure this fungal disease.

## 2. Methodology

The study population included persons from three different randomly selected locations of six cities of Gujranwala division. This survey was conducted from January to March 2019 and 30 persons were examined from each location. Clinically various types of onychomycosis were recorded on basis of morphological characteristics of nails: nail plate thickening, discoloration, onycholysis, nail deformation and subungual hyperkeratosis. For all participants, the noted observations were categorized as: distal and lateral subungual onychomycosis (DLSO), proximal subungual onychomycosis (PSO), subjects with suspected superficial white onychomycosis (SWO) and *Candida* onychomycosis (CO). All participants provided an informed consent to participate in the study. The study was approved by the Ethics Committee of Department of Zoology, University of Gujrat (sub campus), Sialkot [28].

## 3. Results and Discussion

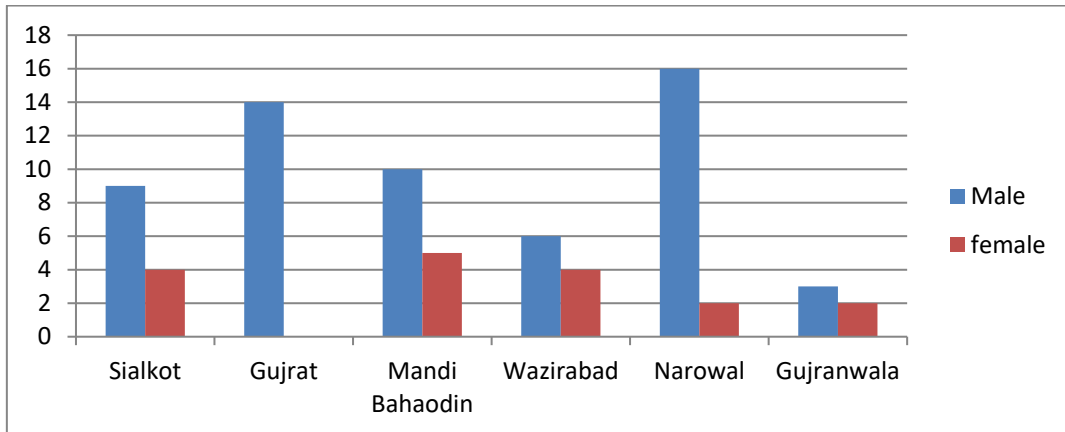
Collected data indicates that onychomycosis considerably exists in the selected region of Gujranwala division, Punjab, Pakistan. Analysis highlights that cases of DLSO were most frequent in Narowal than in Gujrat, Sialkot, Mandi bahaodin, Gujranwala and Wazirabad. Whereas, sufferers of WSO were noticed in Mandi bahaodin, whereas, not a single case was reported in Gujranwala. Similarly, CO cases were observed in all selected cities excluding Gujranwala. Strikingly, PSO patients were noted only in Gujrat (Figure No.1). Overall higher prevalence of DLSO can be noticed from collected data which indicates that like other regions of the world [9-10], this kind of nail fungal disorder is also common in Pakistan than its other reported types. It is also important to mention here that onychomycosis is more frequent in rural areas of this selected region than in urban zones because villagers not only lack awareness related to this disease but also lack proper facilities for its treatment and control.



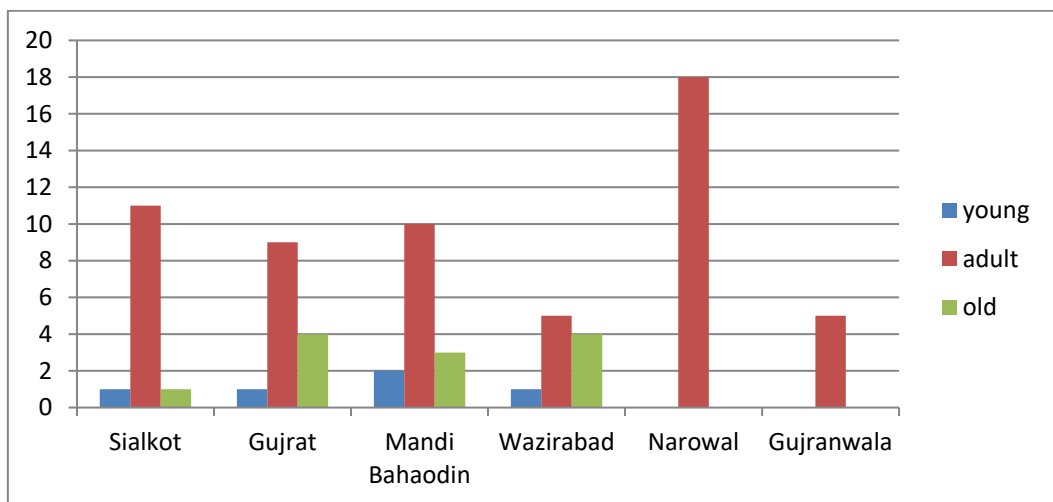
**Figure 1:** Graphical presentation of occurrence frequency of different types of onychomycosis in Gujranwala division, Punjab, Pakistan

Moreover, gender based comparison indicates that males are more suffering from onychomycosis than females in Gujranwala division cities. Maximum cases of affected males were reported from Narowal and minimum

from Gujranwala. Whereas females of Mandi Bahaodin were found affected more than of other cities (Figure No. 2). It happen because Pakistan is a male dominating society so males are more exposed to various environmental conditions than female who usually remain in confined and neat home environment so may have less chances of nail fungal infection exposure but this trend can be noticed in other zones of world too [20]. According to the age based comparison, adults (13-49years age) were found overall more sufferers of nail fungal attack than older ones (above 50years age) whereas occurrence frequency of onychomycosis was found comparatively lower in young ones (up to 12years age) (Figure No.3). The reason may be as adults are in more contact with external surroundings in daily life than females.



**Figure 2:** Graphical presentation of comparative occurrence frequency (gender wise) of onychomycosis in Gujranwala division, Punjab, Pakistan



**Figure 3:** Graphical presentation of comparative occurrence frequency of onychomycosis among various age groups in Gujranwala division, Punjab, Pakistan

**Table 1:** Statistical analyses of different parameters related to onychomycosis

Selected Parameters	Types of Onychomycosis				Gender		Age groups		
	DSO	WSO	CO	PSO	Male	Female	Young	Adult	Old
	0.0885***	0.167	0.0352	0.002	58***	17	5	54***	12

\*\*\* Statistically highly significant difference (P < 0.001)

Statistical analyses based on ANOVA single factor analysis indicated that among four types of nail fungal diseases, the ratio of DLSO was found significantly higher than other types. Similarly, gender based comparison showed that the fungal attack on nails was more common in males than females in different cities of Gujranwala division. Whereas statistical estimation indicated that the major effectors of onychomycosis were adults (Table No.1) due to various environmental factors.

#### 4. Conclusion

In the light of obtained results, it can be concluded that general public of Pakistan still lacks overall health awareness regarding hygiene and people who are more exposed to environment are more prone to get nail fungal infections. They are also unaware of symptoms of onychomycosis and its consequences. Another influential factor is poverty which also indirectly enhances rate of fungal infections as people are bound to use even infected goods like leather items, shoes etc. to reduce their expenses.

#### 5. Recommendations

In future, such steps should be taken by the government/non-government organizations to aware people about personal health care and hygiene and researchers should find out low cost local alternative treatments to control onychomycosis.

#### References

- [1] E. O. M. Herrera, S. A. Camarena, D. L. T. Garcia, C. F. P. Lopez and R. Arenas, "Onychomycosis due to opportunistic molds." *An Bras Dermatol*, vol. 90(3), pp. 334–337. 2015.
- [2] H. Jarve, P. Naaber, S. Kaur and H. Silm, "Toe nail onychomycosis in Estonia." *Mycosis*, vol. 47, pp. 57-61. 2004.
- [3] L. T. Zane, S. Chanda, D. Coronado and J. Del Rosso, "Antifungal agents for onychomycosis: new treatment strategies to improve safety." *Dermatology Online Journal*, vol. 22(3), 1. 2016.
- [4] A. K. Gupta, "Types of onychomycosis." *Cutis*, vol. 68, pp. 4-7. 2001.

- [5] D. T. Roberts, W. D. Taylor and J. Boyle, "Guidelines for treatment of onychomycosis." *Br J Dermatol*, vol. 148, pp. 402–410. 2003.
- [6] S. Verma and M. P. Heffernan, "Fungal Diseases. In *Dermatology in General Medicine*." 7th edn. Philadelphia, pp. 1807-1811. 2008.
- [7] R. J. Hay, and H. R. Ashbee, "Mycology. In: *Rook's Textbook of Dermatology*." 8th edn. London: Blackwell Science, vol. 36, pp. 18-35. 2010.
- [8] A. Bonifaz, "Micologia superficially pseudomicologia: onicomycosis. In: *Micologia Medica Basica*." Mexico: Mc Graw Hill, pp. 106– 109. 2012.
- [9] J. Garmendia and P. Viedma, "Onychomycosis: diagnosis and treatment." *Inf Ter Sist Nac Salud*, vol. 32, pp. 83–92. 2008.
- [10] A. Tully and K. Trayes, "Evaluation of nail abnormalities." *Am Fam Physician*, vol. 85, pp. 779–787. 2012.
- [11] A. Rafiq, A. Zakaria, L. Khondker, M. S. I. Khan, S. Doulah and S. C. Hazra, "Clinicomycological correlation in onychomycosis in a tertiary level hospital." *J. Pakistan Assoc. Dermatol*, vol. 23, pp. 277-283. 2013.
- [12] A. K. Gupta, D. Daigle and K. A. Foley, "The prevalence of culture confirmed toenail onychomycosis in at-risk patient populations." *J Eur Acad Dermatol Venereol*, vol. 29, pp. 1039–1044. 2015.
- [13] B. Richert, M. Caucanas and A. Josette, "Diagnosis using nail matrix." *Dermatol Clin*, vol. 33, pp. 243–255. 2015.
- [14] J. Faergemann and R. Baran, "Epidemiology, clinical presentation and diagnosis of onychomycosis." *British J. Dermatol*, vol. 149, pp. 1-4. 2003.
- [15] D. Trofa, A. Gacser and J. D. Nosanchuk, "Candida parapsilosis, an emerging fungal pathogen." *Clin Microbiol Rev*, vol. 21, pp. 606–25. 2008.
- [16] D. Westerberg and M. Voyack, "Onychomycosis: Current trends in diagnosis and treatment." *American Family Physician*, vol. 88(11), pp. 762-770. 2013.
- [17] B. Sigurgeirsson and O. Steingrímsson, "Risk factors associated with onychomycosis." *J Eur Acad Dermatol Venereol*, vol. 18, pp. 48–51. 2003.
- [18] M. Rana, F. Altaf, B. Bashir and Z. Rani, "Frequency of associated factors of onychomycosis." *Journal of Pakistan Association of Dermatologists*, vol. 27(3), pp. 226-231. 2017.

- [19] B. Ahmadi, S. J. Hashemi and F. Zaini, "A case of onychomycosis caused by *Aspergillus candidus*." *Medical Mycology*, vol. 1(1), pp. 45–48. 2012.
- [20] M. A. Ghannoum, R. A. Hajjeh, R. Scher, N. Konnikov, A. K. Gupta, R. Summerbell, S. Sullivan, R. Daniel, P. Krusinski, P. Fleckman, P. Rich, R. Odom, R. Aly, D. Pariser, M. Zaiac, G. Rebell, J. Leshner, B. Gerlach, G. F. Ponce-De-Leon, A. Ghannoum, J. Warner, N. Isham and B. Elewski, "A large-scale North American study of fungal isolates from nails: the frequency of onychomycosis, fungal distribution, and antifungal susceptibility patterns." *J Am Acad Dermatol*, vol. 43(4), pp. 641-648. 2000.
- [21] T. E. Meireles, M. F. Rocha, R. S. Brilhante, A. Cordeiro and J. J. Sidrim, "Successive mycological nail tests for onychomycosis: a strategy to improve diagnosis efficiency." *Braz. J. Infect. Dis*, vol. 12(4), pp. 333-337. 2008.
- [22] C. Seebacher, J. Brasch, D. Abeck, O. Cornely, I. Effendy and G. Hanselmayer, "Onychomycosis." *Mycoses*, vol. 50, pp. 321-327. 2007.
- [23] P. Veer, N. S. Patwardhan and A. S. Damle, "Study of onychomycosis : Prevailing fungi and pattern of infection." *Indian J. Med. Microbiol*, vol. 25(1), 53-56. 2007.
- [24] A. Singal and D. Khanna, "Onychomycosis: diagnosis and management." *Indian J. Dermatol*, vol. 77, pp. 659-672. 2011.
- [25] A. K. Gupta, C. Drummond-Main and Cooper, "Systematic review of nondermatophyte mold onychomycosis: diagnosis, clinical types, epidemiology, and treatment." *J Am Acad Dermatol*, vol. 66, pp. 494–502. 2012.
- [26] U. Narain and A. K. Bajaj, "Onychomycosis: Role of non dermatophytes." *Int. J. Adv. Med*, vol. 3(3), pp. 643-647. 2016.
- [27] F. Crawford, M. Inkster, J. Kleiyneny and T. Fahey, "Predicting foot ulcer in patients with diabetes: a systematic review and meta-analysis." *QJM*, vol. 100, pp. 65-86. 2007.
- [28] E. Dubljanin, A. D. Zamic, I. Vujcic, S. Sandra, Grujicic, A. Valentina, Arsenijevic, S. Mitrovic and I. C. Calovski, "Epidemiology of onychomycosis in Serbia: a laboratory-based survey and risk factor identification." *Mycoses*, vol. 60, 25–32. 2017.