

## Prevalence of Candidiasis in Chennai Population

Research Article

Nor Masitah Mohamed Shukri<sup>1</sup>, Manjari Chaudhary<sup>2\*</sup>, Arthi Balasubramaniam<sup>3</sup>

<sup>1</sup> Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.

<sup>2</sup> Senior Lecturer, Department of Oral Medicine and Radiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.

<sup>3</sup> Senior Lecturer, Department of Public Health Dentistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.

### Abstract

A candidiasis is described as a group of yeast-like infection, primarily seen in the oral cavity. This fungal infection is pathogenic and generally occurs in humans as results of weak immune systems and poor oral hygiene. In many countries, Candidiasis that affects the mouth is also known as thrush or oropharyngeal candidiasis. The symptoms can be varying depending on the body parts affected. In the oral cavity, candidiasis can be presented with white patches on the tongue or other areas and leads to soreness and swallowing difficulty. This study sought to assess the prevalence of candidiasis among the Chennai population. Data collection was done in a dental university setting. A total of 26 case records were retrieved after analyzing all available case records, starting from June 2019 till February 2020. The case records were examined individually and the parameters of age, gender and diagnosis of candidiasis were recorded. Excel tabulation and SPSS version 23 were used for data analysis. There were 26 patients who were found to be diagnosed with candidiasis. The prevalence of candidiasis was reported higher among male patients (69.2%) than female patients (30.8%). The most common age groups having this infection were 35-50 years and 51-60 years with the same frequency (34.6%). There was an increased proportion of males diagnosed with candidiasis. Within the limits of this study, the candidiasis is highly prevalent in male patients within the age of 35 years and older.

**Keywords:** Candidiasis; *Candida Albicans*; Hygiene; Infections.

## Introduction

The normal flora of our oral cavity encompasses nutrients, epithelial debris and gland secretions in which it favors as a habitat for a diverse type of organisms. They are mostly fungi, mycoplasmas, protozoa, archaea and oral bacteria such as streptococci, lactobacilli, staphylococci and corynebacteria. Fungi are eukaryotic organisms that can be divided into round fungi (yeasts), filamentous fungi (moulds) and combination of both (dimorphic fungi). Candida is the shortened name used to recount a class of fungi that has a population of over 150 species. On top of that, there are approximately 700 species of microorganisms in our human oral cavity, among which 20 species of *Candida* [1-3].

*Candida* species are known as the beneficial flora that harmlessly exists in our human skin and mucosa. However, these species

have been reported as risk pathogens as results of excessive intake of a broad spectrum of antibiotics, HIV infection, organ transplantation, long-term hospitalization and malignant diseases [4, 5]. The wide range of infections caused by these species include bloodstream infections (BSIs) and disseminated candidiasis. In the United States, *Candida* ranks fourth and seventh in Europe in relation to the BSI [6-8]. This lesion is mainly caused by the *Candida albicans*. Studies in India are very limited and only few studies have reported the prevalence of candidemia (6-18%) [9-11]. *Candida* species are considered as the inhabitants of the normal flora in the oral cavity and gastrointestinal tract. The most virulent and pathogenic among these species is known as *Candida albicans*. It is the principal species that is highly related in human oral mycoses [12-14].

Candidiasis is a common opportunistic fungal infection of *Candida* species that affects oral mucosa. The predominant ones are

### \*Corresponding Author:

Manjari Chaudhary,  
Senior Lecturer, Department of Oral Medicine and Radiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.  
Tel: +919326518695  
E-mail: manjaric.sdc@saveetha.com

**Received:** October 26, 2019

**Accepted:** November 20, 2019

**Published:** November 21, 2019

**Citation:** Nor Masitah Mohamed Shukri, Manjari Chaudhary, Arthi Balasubramaniam. Prevalence of Candidiasis in Chennai Population. *Int J Dentistry Oral Sci.* 2019;S4:02:001:1-5.  
doi: <http://dx.doi.org/10.19070/2377-8075-SI02-04001>

**Copyright:** Manjari Chaudhary®2019. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

*Candida albicans* (the commonest), *Candida tropicalis*, *Candida glabrata*, *Candida guilliermondii*, *Candida pseudotropicalis*, *Candida krusei*, *Candida lusitaniae*, *Candida parapsilosis*, and *Candida stellatoidea*. This lesion is often misdiagnosed or undiagnosed in older people, especially in patients wearing dental prostheses and with poor oral hygiene care. It is also more prevalent in immunocompromised patients and systemic diseases such as diabetes mellitus, anemia and cardiac problems [15, 16]. 80% of clinical infections were reported in association of *C. albicans*, *C. glabrata* and *C. tropicalis* [17, 18]. On top of that, oral *candida* infection has been associated with several drugs. These drugs are known as predisposing factors for oral candidiasis in which they may have suppressive effects on the normal pH of the oral bacterial flora either through the T-cell mediated immunity or nonspecific inflammatory response and leads to *Candida* overgrowth. Antidiuretics, antidepressants, anticholinergics, antipsychotics and antihypertensives are the potential drugs to cause dry mouth effects in oral candidiasis [17].

Globally, oral candidiasis is the most common fungal infection, primarily observed in the young aged and elderly population. The carriage rates were reported to be in the range of 20% to 75% for the past few decades [19, 20]. The prevalence of oral candidiasis in humans with predominant *Candida albicans* have been found to be 45% neonates, 45-65% in adolescents and 30-45% in healthy adults. Next, individuals with prolonged use of dentures presented with 50-65% incidence rate, 65-88% in those long-term hospital stay, 90% in those undergoing chemotherapy and radiotherapy of acute leukemia and 95% in patients with HIV infection [17, 21, 22]. In general, oral candidiasis is considered a common phenomenon and it is usually asymptomatic in systematically healthy people. Nevertheless, the severity and extensive growth rate of fungi can lead to symptoms of discomfort, dysgeusia, severe mucositis and swallowing difficulties, which leads to poor nutrition [23, 24].

The pathogenesis of oral candidiasis can be possibly explained with the ability of *Candida albicans* to transform into hyphal phase and germ tubes that are the onset of hyphal growth in this lesion [25]. Once the overgrowth colonization of this species in the oral cavity completes, it facilitates a pathway for yeasts to reach the respiratory system. Thereby, oral candidiasis poses a risk factor of systemic diseases and local mucosal infection, especially in elderly population [26]. Older aged communities are more vulnerable and harbor to candidiasis because of their low immunity system, some may have predisposed to systemic disorders and the medication intake [27, 28].

There is rarity in the literature of similar study within Indian population considering limited investigations and evidence regarding the prevalence of oral candidiasis in the general population. Thus, this study was conducted to assess the prevalence of candidiasis among the Chennai population.

## Materials and Method

This is a retrospective cross sectional study carried out from June 2019 to March 2020 and it was covered by the following ethical approval number; SDC/SIHEC/2020/DIASDATA/0618-0319. It was taking place in Saveetha Dental College and Hospital in relation to the South Indian population. The advantage of this study was large data availability. However, it was conducted on a limited time frame and geographically only focused on the isolat-

ed population. Ethical approval for the study was obtained from the Institutional Ethics Committee. Case records of the patients were reviewed individually. Two external examiners were involved in this study. The sampling bias was minimized with all inclusion of data and cross verification done by verifying with photographs.

## Data Collection

Data regarding patients diagnosed with candidiasis were retrieved after analyzing 86000 case sheets. The following parameters were evaluated based on the dental records; age and gender. Clinical examinations and treatment reports of the patients were examined for the data collection. Internal validity of this study was inclusion of all samples diagnosed with associated condition and external validity was defining the eligibility criteria of the sample and epidemiology perspective. The inclusion criterion of this study was dentate patients above 18 years diagnosed with candidiasis.

## Statistical Analysis

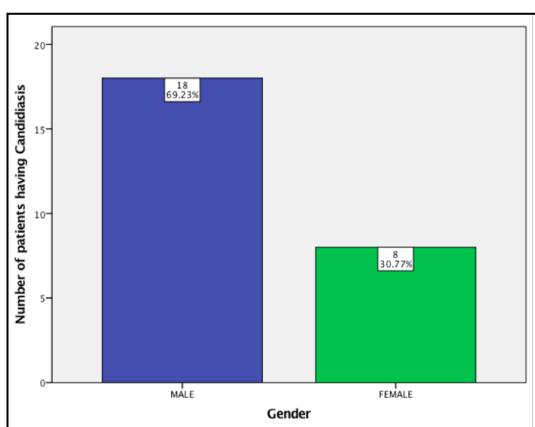
All the data collected were tabulated in MS Excel and incomplete data was eliminated. Data analysis was carried out using IBM Statistical Package for Social Science (SPSS version 23). The statistical test used for the demographics was frequency distribution. Descriptive statistic was calculated using Chi-square t test. P value less than 0.05 was set as statistically significant. Frequency distribution for age and gender was calculated.

## Results and Discussion

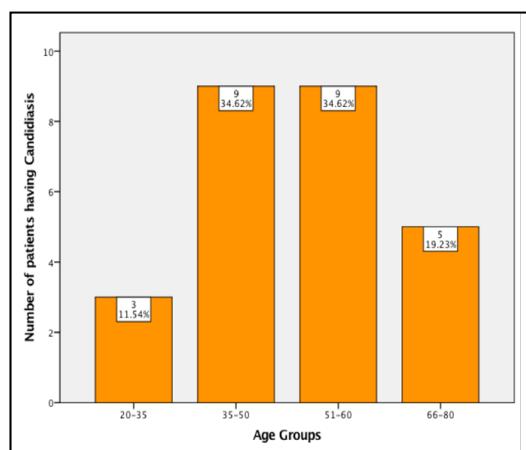
There are various types of oral candidiasis including acute pseudomembranous, acute atrophic, chronic hyperplastic, denture stomatitis, median rhomboid glossitis, and angular cheilitis. They generally exhibit as white plaques resembling curdled milk on the affected surfaces. The candidiasis may spread to the esophageal area which occasionally can be life threatening. The variables considered in this study include age and gender of the patients affected with candidiasis. According to the analysis done, 26 patients were found to be diagnosed with candidiasis. The prevalence of candidiasis was reported higher among male patients (69.23%) than female patients (30.77%), as displayed in Figure 1. The prevalence of oral candidiasis in this showed that more than halves of male patients were highly affected as compared to female patients. This is consistent with a previous study of oral candidiasis in Kolkata, which reported 27 were men (79.4%) and 7 were women (20.6%) [29]. Few previous studies also reported the percentage of males with *Candida* species infections were more predominant than females [30, 31]. The gender wise distribution of oral candidiasis by Rathod et al., demonstrated equal frequency in the both sexes, except where HIV infection in males outnumber females [27]. The probable factors of male predominance are males had poor oral hygiene than females and they are more related with systemic disease such as diabetes mellitus and HIV infection.

In each age group of this study, Figure 2 depicts oral candidiasis was more frequent in 35-50 years and 51-60 years with the same percentage (34.62%). The smallest percentage was found in the age group of 20-35 years (11.54%). Therefore, the greatest percentage of candidiasis was seen in the older group, corroborating with Loster et al that older people were commonly infected with candidiasis [32]. Furnaleto et al., also found that infections

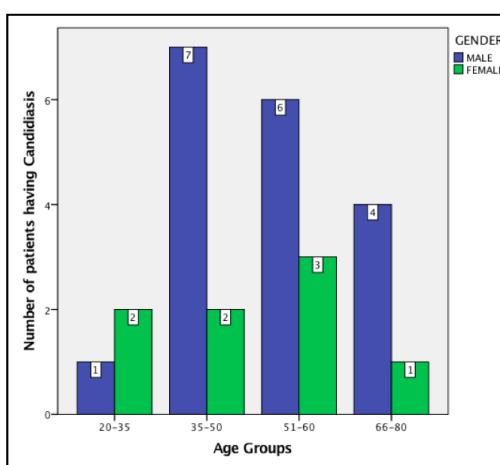
**Figure 1.** Bar graph shows frequency of candidiasis based on gender of study population. X axis represents the distribution of gender. Y axis represents the number of patients having Candidiasis. Males (blue) and females (green). Males showed (69.23%) the highest prevalence of candidiasis followed by females (30.77%).



**Figure 2.** Bar graph shows frequency distribution of candidiasis based on age groups. X axis represents the distribution of age groups. Y axis represents the number of patients having Candidiasis. Candidiasis was equally more prevalent among age groups of 35-50 years and 51-60 years (34.62%), followed by 66-80 years (19.23%) and 20-35 years (11.54%).



**Figure 3.** Bar graph depicts the association between age groups and gender. X axis represents age groups and the Y axis represents gender. Males (blue) and females (green). Chi square test was done and association was found to be statistically insignificant between age groups and gender. Pearson's Chi-square value - 2.423 ; p = 0.489 ( $p>0.05$ ), hence statistically insignificant. Candidiasis was more prevalent among male patients within the age group of 35-50 years ( $n=7$ ) when compared to 51-60 years ( $n=6$ ) and 66-80 years ( $n=4$ ).



caused by *Candida* species were more frequent in the elderly. The age distribution of this study also correlates the findings of another study that most of the patients infected were within the age group of 51-60 years [29]. A study with a background of post-disaster areas reported high *Candida* colonization among elderly aged 65-75 years or in patients associated with HIV, carcinoma or diabetes. The reported prevalence rates were 63.6% for total

*Candida* and 53.4% for *C. albicans*. He also stated a stable non-progressive colonization of *C. albicans* and progressive colonization of non-*Candida*, harboured by the elderly population. This study suggested that incidence of oral candidiasis has been recognized in the elderly, which possibly could be linked with poor nutrition and weakened immune system. Additional reasons include extreme age, low salivary flow rate and the use of dentures [27].

Based on the distribution of age groups in gender predilection, there was an increased proportion of males diagnosed with candidiasis regardless their age groups with insignificant difference ( $p=0.489$ ), demonstrated in Figure 3. This suggested that a difference between both sexes did not occur though there was an increased proportion of males diagnosed with candidiasis regardless their age groups. Similarly, Loster et al revealed that the difference in the distribution of candidiasis across patient gender and age was not statistically significant with females showing the greatest frequency of candidiasis in respect to age groups distribution [32]. In corroborating to this, Sato et al also found insignificance correlation between both sexes either in the colony amount of *C. albicans* and non-*Candida* [27]. More detailed studies are required to investigate and determine the reason for this difference in gender prevalence.

Our study was limited to a small sample size distribution within a short duration of investigation and geographic limitation. Other shortcomings of this study include the analysis based on the classification and types of oral candidiasis were not mentioned in this study. There is a need for extensive larger scale-study with richer clinical data in order to obtain more accuracy of the findings in association of different community-based investigations. Further, the research design of future studies can be established in both control areas and post-disaster areas with the inclusion of different species of *C. albicans* and non-*Candida*. Plus, systemic diseases, living conditions and oral status could affect the prevalence of Candidiasis.

## Conclusion

Within the limits of this study, the prevalence of candidiasis in the Chennai population was substantially low. Male patients were more prevalent in having this infection as compared to female patients. Considering the higher prevalence of candidiasis among the middle-aged and elderly population, there should be absolute necessities in prevention and management approaches. Maintaining good oral hygiene and long term follow-up in elderly patients are also needed.

## Acknowledgements

We would like to thank Saveetha Dental College and Hospital for the contributions and involvement through this study.

## References

- [1]. Aas JA, Paster BJ, Stokes LN, Olsen I, Dewhirst FE (2005). Defining the Normal Bacterial Flora of the Oral Cavity [Internet]. Journal of Clinical Microbiology. 43:5721–32. Available from: <http://dx.doi.org/10.1128/jcm.43.11.5721-5732.2005>
- [2]. Ribeiro DG, Pavarina AC, Dovigo LN, Machado AL, Giampaolo ET, et al (2012 Sep). Prevalence of *Candida* spp. associated with bacteria species on complete dentures. Gerodontology [Internet]. 29(3):203–8. Available from: <http://dx.doi.org/10.1111/j.1741-2358.2011.00578.x>
- [3]. Venugopal A, Uma Maheswari TN (2016 Sep). Expression of matrix metalloproteinase-9 in oral potentially malignant disorders: A systematic review. J Oral Maxillofac Pathol [Internet]. 20(3):474–9. Available from: <http://dx.doi.org/10.4103/0973-029X.190951>
- [4]. Messer SA, Jones RN, Fritsche TR (2006 May). International surveillance of *Candida* spp. and *Aspergillus* spp.: report from the SENTRY Antimicrobial Surveillance Program (2003). J Clin Microbiol [Internet]. 44(5):1782–7. Available from: <http://dx.doi.org/10.1128/JCM.44.5.1782-1787.2006>
- [5]. Richardson M, Lass-Flörl C (2008 May). Changing epidemiology of systemic fungal infections. Clin Microbiol Infect [Internet]. 14 Suppl 4:5–24. Available from: <http://dx.doi.org/10.1111/j.1469-0691.2008.01978.x>
- [6]. Wisplinghoff H, Bischoff T, Tallent SM, Seifert H, Wenzel RP, et al (2004 Aug 1). Nosocomial bloodstream infections in US hospitals: analysis of 24,179 cases from a prospective nationwide surveillance study. Clin Infect Dis [Internet]. 39(3):309–17. Available from: <http://dx.doi.org/10.1086/421946>
- [7]. Marchetti O, Bille J, Fluckiger U, Eggimann P, Ruef C, et al (2004 Feb 1). Epidemiology of candidemia in Swiss tertiary care hospitals: secular trends, 1991–2000. Clin Infect Dis [Internet]. 38(3):311–20. Available from: <http://dx.doi.org/10.1086/380637>
- [8]. Yapan N (2014). Epidemiology and risk factors for invasive candidiasis [Internet]. Therapeutics and Clinical Risk Management. p 95. Available from: <http://dx.doi.org/10.2147/tcrm.s40160>
- [9]. Magill SS, Shields C, Sears CL, Choti M, Merz WG (2006 Feb). Triazole cross-resistance among *Candida* spp.: case report, occurrence among bloodstream isolates, and implications for antifungal therapy. J Clin Microbiol [Internet]. 44(2):529–35. Available from: <http://dx.doi.org/10.1128/JCM.44.2.529-535.2006>
- [10]. Chaitanya NC (2017). Role of Vitamin E and Vitamin A in Oral Mucositis Induced by Cancer Chemo/Radiotherapy- A Meta-analysis [Internet]. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. Available from: <http://dx.doi.org/10.7860/jcdr/2017/26845.9905>
- [11]. Subashri A, Uma Maheswari TN (2016). Knowledge and attitude of oral hygiene practice among dental students [Internet]. Research Journal of Pharmacy and Technology. 9:1840. Available from: <http://dx.doi.org/10.5958/0974-360x.2016.00375.9>
- [12]. Samaranayake LP MTW. Oral candidosis. London: Wright. 1990.
- [13]. Maheswari TNU, Venugopal A, Sureshbabu NM, Ramani P (2018 Apr). Salivary micro RNA as a potential biomarker in oral potentially malignant disorders: A systematic review. Ci Ji Yi Xue Za Zhi [Internet]. 30(2):55–60. Available from: [http://dx.doi.org/10.4103/tcmj.tcmj\\_114\\_17](http://dx.doi.org/10.4103/tcmj.tcmj_114_17)
- [14]. Misra SR, Shankar YU, Rastogi V, Maragathavalli G (2015 Mar). Metastatic hepatocellular carcinoma in the maxilla and mandible, an extremely rare presentation. Contemp Clin Dent [Internet]. 6(Suppl 1):S117–21. Available from: <http://dx.doi.org/10.4103/0976-237X.152966>
- [15]. Boriollo MFG, Bassi RC, dos Santos Nascimento CMG, Feliciano LM, Francisco SB, et al (2009 Dec). Distribution and hydrolytic enzyme characteristics of *Candida albicans* strains isolated from diabetic patients and their non-diabetic consorts. Oral Microbiol Immunol [Internet]. 24(6):437–50. Available from: <http://dx.doi.org/10.1111/j.1399-302X.2009.00524.x>
- [16]. Steele JC, Clark HJ, Hong CHL, Jurge S, Muthukrishnan A, et al (2015). World Workshop on Oral Medicine VI: an international validation study of clinical competencies for advanced training in oral medicine [Internet]. Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology. 120:143–51. e7. Available from: <http://dx.doi.org/10.1016/j.oooo.2014.12.026>
- [17]. Krishnan P (2012). Fungal infections of the oral mucosa [Internet]. Indian Journal of Dental Research. 23:650. Available from: <http://dx.doi.org/10.4103/0970-9290.107384>
- [18]. Muthukrishnan A, Warnakulasuriya S (2018 July). Oral health consequences of smokeless tobacco use. Indian J Med Res [Internet]. 148(1):35–40. Available from: [http://dx.doi.org/10.4103/ijmr.IJMR\\_1793\\_17](http://dx.doi.org/10.4103/ijmr.IJMR_1793_17)
- [19]. Patil SR, Maragathavalli G, Araki K, Al-Zoubi IA, Sghaireen MG, et al (2018). Three-Rooted Mandibular First Molars in a Saudi Arabian Population: A CBCT Study [Internet]. Pesquisa Brasileira em Odontopediatria e Clínica Integrada. 18:e4133. Available from: <http://dx.doi.org/10.4034/pboci.2018.181.87>
- [20]. Muthukrishnan A, Kumar LB (2017). Actinic cheilosis: early intervention prevents malignant transformation [Internet]. BMJ Case Reports. p. bcr2016218654. Available from: <http://dx.doi.org/10.1136/bcr-2016-218654>
- [21]. Chaitanya N, Muthukrishnan A, Krishnaprasad CMS, Sanjurprasan G, Pillay P, et al (2018). An insight and update on the analgesic properties of vitamin C [Internet]. Journal of Pharmacy And Bioallied Sciences. 10:119. Available from: [http://dx.doi.org/10.4103/jpbs.jpbs\\_12\\_18](http://dx.doi.org/10.4103/jpbs.jpbs_12_18)
- [22]. Rohini S, Kumar VJ. Incidence of dental caries and pericoronitis associated with impacted mandibular third molar-A radiographic study. Research Journal of Pharmacy and Technology. 2017;10(4):1081–4.
- [23]. Dharman S, Muthukrishnan A. Oral mucous membrane pemphigoid—Two case reports with varied clinical presentation. Journal of Indian Society of Periodontology. 2016 Nov;20(6):630.
- [24]. Subha M, Arvind M. Role of magnetic resonance imaging in evaluation of trigeminal neuralgia with its anatomical correlation. Biomedical and Pharmacology Journal. 2019 Mar 25;12(1):289–96.
- [25]. Ghannoum MA, Radwan SS. Candida Adherence to Epithelial Cells [Internet]. 2018. Available from: <http://dx.doi.org/10.1201/9781351070416>
- [26]. Choudhury P, Panigrahi RG, Maragathavalli AP, Patra PC. Vanishing roots:

- first case report of idiopathic multiple cervico-apical external root resorption. Journal of clinical and diagnostic research; JCDR. 2015 Mar;9(3):ZD17.
- [27]. Rathod P, Punga R, Dalal V, Rathod D. Oral Candidiasis-widely prevalent, frequently missed. Int J Sci Study. 2015 Sep 1;3:193-8.
- [28]. Muthukrishnan A, Bijai Kumar L, Ramalingam G. Medication-related osteonecrosis of the jaw: a dentist's nightmare. BMJ Case Rep. 2016 Apr 6;2016:bcr2016214626. PMID: 27053542.
- [29]. Sato T, Kishi M, Suda M, Sakata K, Shimoda H, Miura H, Ogawa A, Kobayashi S. Prevalence of *Candida albicans* and non-albicans on the tongue dura of elderly people living in a post-disaster area: a cross-sectional survey. BMC Oral Health. 2017 Feb 1;17(1):51. PMID: 28148273.
- [30]. Loster JE, Wieczorek A, Loster BW. Correlation between age and gender in *Candida* species infections of complete denture wearers: a retrospective analysis. Clin Interv Aging. 2016 Nov 21;11:1707-1714. PMID: 27920509.
- [31]. Prakash B, Shekar M, Maiti B, Karunasagar I, Padiyath S. Prevalence of

*Candida* spp. among healthy denture and nondenture wearers with respect to hygiene and age. J Indian Prosthodont Soc. 2015 Jan-Mar;15(1):29-32. PMID: 26929483

- [32]. Bhattacharjee P. Epidemiology and antifungal susceptibility of *Candida* species in a tertiary care hospital, Kolkata, India. Curr Med Mycol. 2016 Jun;2(2):20-27. Pubmed PMID: 28681016.

#### " Oral Microbiology and Dental Infection"

Theme Edited by:  
Harry D. Koumoullis,  
University of Aberdeen Medical School & Health Sciences, UK  
E-mail: f\_hattab@hotmail.com