Prevalence of Candida albicans Infection in the Oral Cavity among Dental Clinic Patients in Taiz City, Yemen

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Abstract:

**Background:** Oral candidiasis is one of the most common oral disease of human caused by *Candida albicans*, and can cause superficial infection. **Objective:** The present study was done to evaluate the prevalence of *Candida albicans* infection in the oral cavity among dental clinic patients in Taiz city, Yemen. And determining the sensitivity of the isolated *Candida albicans* to some antifungal drugs and plant extracts. **Methods:** A total (200) specimens with oral candidiasis have been collected from dental patients by using the oral rinse technique, from October 2021 to January 2022. Diagnosed by dentist of clinics and hospitals, and identified by microbiological procedures. **Results:** Most of the isolates were *Candida albicans* representing in 101(50.5%) of total oral sample isolates. The non-Albicans species are the second most common representing in 51(25.5%). The remaining oral sample isolates are of non-yeast growth representing in 48(24%). Fluconazole and Itraconazole have been tested against 20 isolates of *C. albicans*. All the drugs, examined in *vitro*, show antifungal sensitivity that shows (80%). Plant extracts of *Salvadora persica* and *Commiphora myrrha* have been tested against 20 isolates of *C. albicans*. Four concentration of alcoholic extracts for investigated plants show antifungal activity in *vitro* better than aqueous extracts. **Conclusions:** *Candida albicans* were the most prevalent isolate from oral cavity of dental patients with oral candidiasis. Plant extracts of *Salvadora persica* and *Commiphora myrrha* show antifungal activity in *vitro*. **Keywords:** *C. albicans*, non-Albicans, Oral Candidiasis.
انتشار عدوى المبيضات البيضاء في التجويف الفموي
بين مرضى عيادات الأسنان في مدينة تعز، اليمن

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الملخص
داء المبيضات الفموي هو أحد أكثر أمراض الفم شيوعًا في الإنسان والتي تسببها المبيضات البيضاء، ويمكن لهذه الفطريات أن تسبب التهابات إبدًا من الالتهابات السطحية للجلد إلى الالتهابات الجهازية التي تهدد الحياة. هدف البحث: أجريت الدراسة لتقديم مقدمة انتشار عدوى المبيضات البيضاء في التجويف الفموي. بين مرضى عيادات الأسنان في مدينة تعز، اليمن. وتحديد حساسية المبيضات البيضاء المعوية لبعض الأدوية المضادة للأفطريات وبعض المستخلصات الببتيدية. الطريقة: تم جمع (200) عينة من مرضى الأسنان المشافي بداء المبيضات الفموي باستخدام تقنية غسول الفم (المضضية)، خلال الفترة من شهر أكتوبر 2021 إلى شهر يناير 2022. تم تشخيصها من قبل أطباء الأسنان في العيادات والمستشفيات، وتم تقييمها ميكروبيولوجيًا في المختبر من خلال مجموعة من الفحوصات. النتائج: معظم العزلات كانت فطريات المبيضات البيضاء، مع نسبة (50%) من جميع العينات الفموية. الأنواع غير المبيضات البيضاء كانت ثانيا أكثر الأنواع شيوعًا بنسبة (25%). أما بالنسبة للفحوصات الفموية فأظهرت عدم نمو للطحالب في (الخمائر) بنسبة (48%). تم اختيار مضادات الفطريات حسب توصيات خبراء العيان. واستنتاجات: جميع الفحوصات الفموية التي تم فحصا في المختبر حساسية ضد الفطريات بنسبة (80%). تم اختيار الانتي جنين من المستخلصات النباتية لنمط السوك والمر على 20 عينة من المبيضات البيضاء. أظهرت أربعة تراكيز من المستخلصات الكحولية للنباتات التي تُستخدم بشكل مستقلًا مضادًا للفطريات في المختبر أفضل من المستخلصات المائية. الاستنتاجات: فطريات المبيضات البيضاء كانت الأكثر انتشارًا في التجويف الفموي بين مرضى الأسنان الذين كان لديهم نزول المبيضات الفموي. أظهرت المستخلصات النباتية السوك والمر نشاطًا مضادًا للفطريات في المختبر.

الكلمات المفتاحية: المبيضات البيضاء، الأنواع غير البيضاء، داء المبيضات الفموي.
1. INTRODUCTION

The oral cavity is a suitable place for the presence of many oral flora, which may be natural inhabitants and coexist with some of them. When there is any imbalance in this relationship or the presence of other predisposing factors, they turn into the pathogen (Leung et al., 2013).

_Candida_ is a fungus and was first isolated in 1844 from the sputum of a tuberculosis patient (Mandell et al., 1994). _Candida sp_ belong to the Eumycota kingdom, family of Ascomycota, according recent classification by Kidd et al. (2016). The _Candida_ species are Gram positive, budding yeast cell that harvests pseudo hyphae both in culture and in tissues and excretions that they exhibit filamentous morphology in the saprophytic phase, grow at 37 °C. Mono-cell yeasts with small (4-8μm) ovoid cells, polymorphic. _Candida_ species produce well on most culture media and usually do not need special media to growth (Ogba et al., 2013).

Oral candidiasis is a superficial opportunistic infection of the oral cavity by _Candida albicans_, first described in 1838 by pediatrician Francois Veilleux. Local and systemic factors facilitating the development of the disease (Scully et al. 1994). It is one of the common fungal infection, affecting the oral mucosa. These lesions are caused by the yeast _Candida albicans_ which is the most common _Candida species_ isolated from the oral cavity in both healthy and diseased states (Vila et al., 2020).

The most prevalent _Candida_ species isolated from the oral cavity is _Candida albicans_ (Cannon et al., 1995; and Coronado-Castellote, & Jiménez-Soriano, 2013). _C. albicans_ is a polymorphic organism because it can grow in yeast, hyphal and pseudo-hyphal modes and may produce chlamydomospores in certain growth conditions (Odds. 1988 reviewed by Cannon and Chaffin., 1999).

Many researchers referred to prevalence of oral candidiasis in the mouth both in normal and pathological state. However, there is no available information about the prevalence of oral candidiasis in Yemen, to the best of our knowledge.

There are two main groups of antifungal drugs; the polyene macrolides, and azole derivatives. In order to successfully treat oral candidiasis, however, if the yeast responsible for the candidiasis develops antifungal drug resistance. Resistance to imidazoles and triazoles, particularly
fluconazole, is more common than to polyenes, allylamines and echinocandins (Cannon et al., 2009 and Jorgensen, 1980).

Many studies noted the effect of plant extract on Candida albicans as Salvadora persica and Commiphora myrrha. Result of a variety of chemical components which have been identified in plants extracts (Bruneton, 1993; Al Bagieh, 1994; Almas et al., 1997 and Abdelrahman et al., 2003). This may be considered to be used as an alternative treatment.

The limited studies that deal with prevalence of Candida albicans among dental patients in Yemen in general and the city of Taiz in particular, was one of the most important reasons for carrying out the present study. In addition, there is a problem in diagnosing oral infections by dentists in Yemen. Confusion between oral candidiasis with oral bacterial infection, can cause a deficiency in the treatment process. There are global reports indicating the increasing phenomenon of Candida albicans resistance to antibiotics (Cannon et al., 2009 and Jorgensen, 1980), and the possibility of using some plant extracts as an alternative treatment to antibiotics.

The aim of this study is to evaluate the prevalence of Candida albicans infection in the oral cavity among dental clinic patients in Taiz city, Yemen. So, the specific objectives of the present investigations have been designed to study estimating the prevalence of Candida albicans that cause oral disease of human regarding sex and age of patients in Taiz city, Yemen, and determining the sensitivity of the isolated Candida albicans to some antifungal drugs and plant extracts, in vitro.

2. MATERIALS & METHODS
2.1. Clinical Diagnosis and Sampling
2.1.1. Ethical Approval

The study proposal was evaluated and approved by the Ethics Committee for Scientific Research of Faculty of Medicine and Health Sciences, Taiz University, reference number: ECTU2022/2-4.

2.1.2. Patients

This study has been carried out within 4 months period starting from October 2021 to January 2022, including 200 outpatient cases with oral candidiasis infection. Diagnosed by dentist of clinics and hospitals, admitted to Hospital and several dental clinics in Taiz city, Yemen.
2.1.3. Samples Collection
A total (200) specimens of oral candidiasis have been collected from dental patients by oral rinse technique. Each case was asked to rinse the mouth for 60 seconds with 10 ml of sterile phosphate-buffered saline (PBS; 0.01M phosphate-buffered saline solution, pH 7.2) and expectorate the wash into a 50 ml sterile container. The samples were immediately transported to the microbiology laboratory (Coulter et al. 1993).

2.2. Identification Process
The mycological identification was based on macroscopic and microscopic examination of the culture isolates. The macroscopic examination of isolated species was characterized by duration of growth, surface morphology and pigment production on the reverse (Emmons et al. 1977; Kidd et al. 2016; & Campbell et al. 2013).

2.2.1. Direct Examination
All isolates were grown on Sabouraud dextrose agar plates, examined microscopically, were placed on clean slide mounted with cover-slip and then the slide wormed mildly and then examined under the microscope looking for Candida budding cells. Moreover the isolates were stained with Gram stain to detect their reply to stain (Saranya et al. 2014 & Yan et al. 2013).

2.2.2. Morphological Tests:
All isolates were grown Sabouraud dextrose agar plates (SDA) and incubated at 37 °C for 24- 48 hrs. to isolate the Candida colonies are pure to study their shape, size, and color and texture. This is according to (Saranya et al. 2014; Kidd et al. 2016 & Campbell et al. 2013).

2.2.3. Germ Tube Production:
C. albicans produce true germ tubes (long tube-like projection extending from the yeast cells) when incubated 2 hrs. in serum at 37 °C (Ahmad et al. 2010 & Reiss et al. 2012).

2.2.4. Hypertonic SDA
Microbiological tests to confirm identification as growth on Hypertonic Sabouraud Agar was produced as described by Alves et al. (2002). Isolates from a 48 hrs. culture on Sabouraud Dextrose agar plates were inoculated on SDA supplemented with 6.5% NaCl and then statically incubated for 96 hrs. at 37 °C.
2.2.5. Growth at 45 °C:

Isolates of *Candida* sp tested for abilities to growth on SDA at 45 °C and monitoring daily for 10 days. Growth at 45 °C was considered a useful test for differentiation *C. albicans* from *C. dubliniensis*, because *C. dubliniensis* (no growth) from *C. albicans* (growth) as described by Pinjon *et al.* (1998).

2.3. Antifungal drugs:

A total (20) isolates of *Candida albicans* from the oral infection were tested for sensitivity against two antifungal agents (HiMedia, India), Fluconazole 10 mcg and itraconazole 30 mcg, using agar disc diffusion method. Overnight grown *Candida albicans* was first adjusted to 0.5 McFarland turbidity standards (1.0x10^8 colony forming units/ml) and seeded onto Sabouraud Dextrose agar plates with a sterile cotton swab. Plates were then left at room temperature for 15 min (Chaudhary *et al.* 2022).

2.4. Plant Extracts:

A total (20) isolates of *Candida albicans* from the oral infection were tested for sensitivity against two of plant extracts using Agar Well Diffusion Technique as described by Cui *et al.* (2021). Aqueous extracts and alcoholic extracts of *Salvadora persica* and *Commiphora myrrha*, were collected from traditional Yemeni marketing at Taiz city. All the plant extracts prepared from Aqueous extracts and alcoholic extracts. Plant samples were dried in the oven at 50 °C for 48 hrs. and then powdered. Twenty grams of this powder were soaked in 200 ml of each of the solvents namely distilled water, ethanol or methanol for 24 hrs. Media was used to evaluate the antifungal activity as Sabouraud Dextrose Agar was used for yeast as described by Koleva *et al.* (2002).

2.5. Data Analysis:

Data were statistically analyzed using the SPSS program version 21. The difference in distribution of the *Candida albicans* between groups was based on comparison of frequency distributions by a chi-square test. p value < 0.05 was considered significant.
3. RESULTS & DISCUSSION
3.1. Microbiological Analysis
3.1.1. Identification of C. albicans

A total of 200 specimens was identified from cases of oral infection among dental patients, during the period from October 2021 to January 2022, contingent on the morphological features on culture medium (Sabourauds dextrose agar and hypertonic sabourauds dextrose agar), germ tube formation, growth at 45 °C and gram stain. Most of the isolates were Candida albicans representing in 101(50.5%) of total oral sample isolates. The non-Albicans species are the second most common representing in 51(25.5%). The remaining oral sample isolates are of non-yeast growth (negative cases), representing in 48(24%) of the total oral sample isolates, so the results of the study show prevalence of Candida albicans in the oral cavity compared to non-Albicans species (Table 1; Fig. 1,2).

Table (1): Microbiological analysis of 200 cases investigated during the period from October 2021- January 2022.

<table>
<thead>
<tr>
<th>Result of Identification</th>
<th>Identification Process</th>
<th>Direct Ex.</th>
<th>Growth on culture media</th>
<th>Germ tube production</th>
<th>Growth at 45 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Wet preparation (yeast cells)</td>
<td>Gram stain (G+)</td>
<td>SDA</td>
<td>Hypertonic SDA</td>
</tr>
<tr>
<td>C. albicans</td>
<td></td>
<td>101</td>
<td>101</td>
<td>101</td>
<td>101</td>
</tr>
<tr>
<td>Non-Albicans</td>
<td></td>
<td>51</td>
<td>51</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>No-yeast growth</td>
<td></td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>152</td>
<td>152</td>
<td>101</td>
<td>105</td>
</tr>
</tbody>
</table>

NA: no analysis SDA: Sabouraud Dextrose Agar.

Fig. (1): Candida albicans colonies growth on (SDA)
Fig. (2): Wet preparation for Candida albicans
Our results about microbiological identification are similar to those obtained by Odds (1991) who reported that the most frequently used primary isolation medium for *Candida* is SDA which, although permitting growth of *Candida*, suppresses the growth of many species of oral bacteria due to its low pH. Akgül & Çerikçioğlu (2009) found that none of the phenotypic methods, except for the modified salt tolerance test, revealed 100% successful results in discrimination of *C. albicans* and *C. dubliniensis* species. It is suggest that in the case of absence of PCR and other identification systems, these two phenotypic tests can be used in routine laboratories to obtain a presumptive result. The germ-tube test is the standard laboratory method for identifying *C. albicans*. The test involves the induction of hyphal outgrowths (germ tubes) when subcultured in horse serum at 37 °C for 2–4 hrs. Approximately, 95% of *C. albicans* isolates produce germ tubes, a property also shared by *C. stellatoidea* and *C. dubliniensis* (Williams and Lewis, 2000).

About detection of growth at 45 °C our results are similar to those obtained by Sullivan *et al.* (1995) that reported that *C. dubliniensis* can grow well at 30 °C and 37 °C, producing creamy white colonies on solid media similar to *C. albicans*. However, differing from *C. albicans*, it grew poorly or was unable to grow at 42 °C on SDA or potato dextrose agar. In contrast to this, Pinjon *et al.* (1998) found that 9.2% of the *C. dubliniensis* isolates showed partial growth at 42 °C after 48 hrs. but that none of the 120 *C. dubliniensis* isolates tested grew at 45 °C after 48 hrs. In the case of *C. albicans*, all 98 isolates grew at 42 °C and 97 grew at 45 °C. Similar results regarding the inability of *C. dubliniensis* isolates to grow at 45 C were obtained by other researchers (Fotedar & Al Hedaithy, 2003; Musleh & Al-Saadi, 2022).

However, our result is different from that of Kurzai *et al.* (2000) that reported that 15.9% of *C. albicans* isolates also failed to grow at 45 °C. In addition, Gales *et al.* (1999) reported that 23% of the tested *C. albicans* isolates failed to grow at 45°C. Kirkpatrick *et al.* (1998) reported an even higher percentage of *C. albicans* isolates (36%) that failed to grow at 45 °C. Pincus *et al.* (1999) stated that these variable results may be explained by poor temperature control in incubators or differences in media composition.
3.2. General Analysis of Oral Infection:
3.2.1. Prevalence of Candida albicans in the Samples Population:

A total of 200 dental patients infected by oral infection has been collected from October 2021 to January 2022. Among the examined specimens 152 samples (76% of total specimens), have oral candidiasis by Candida albicans and non-Albicans species. Among the positive oral candidiasis, 101 (50.5% of total specimens) are infected by Candida albicans. Whereas 51(25.5% of total specimens) are infected by non-Albicans species. While the remaining specimens 48(24%) have shown no yeast growth - negative cases (Fig.3). These results are similar to those obtained by Rindum et al. (1994). This study comprised 100 healthy dentate adults and 53 patients with oral candidiasis. The isolated yeasts were identified to species level. Strain phenotypes of 147 Candida albicans isolates.

Martins et al. (2010), studied oral Candida carriage of patients attending a dental clinic in Braga, Portugal, a total of 97 patients were analyzed. It showed that, C. albicans was identified in 79% of the samples, being the predominant Candida species. Muadcheingka & Tantivitayakl (2015) investigated the prevalence of Candida albicans and non-albicans Candida (NAC) species from oral candidiasis patients in 207 oral candidiasis patients. The results are: C. albicans (61.6%) was still the predominant species in oral candidiasis patients with and without denture wearer, respectively, followed by non-albicans Candida (NAC) species. The proportion of mixed colonization with more than one Candida species was 18% from total cases.
Similar observation about the prevalence of Candida albicans on oral cavity reported by Alrayyes et al. (2019) who observed that out of the 104 subjects examined, 45 (43.4%) were found to be colonized with Candida spp. C. albicans was the most frequently encountered being isolated from 23 (21.9%) individuals and constituting (55.64%) of the total isolates. Other Candida species were also isolated though less frequently as C. glabrata and C. krusei both being found in 5 (11%), 4 C. dubliniensis (8.9%), 3 C. parapsilosis (6.7), 2 C. tropicalis (4.4%), and 1 (2.2%) C. famata.

3.2.2. Incidence of Oral Candidiasis In Relation to the Sex of Patients:

The microbiological analysis of oral infection patients in relation to sex of dental patients is illustrated in fig. (4). The results of Candida albicans infection were indicated that the female patients are highly than of male patients. This has occurrence in 56.4% of female, and 43.6% of male patients. Results of chi-square test show that there is no statistically significant association between sex of dental patients and Candida albicans infections P=0.679 (P>0.05) (Fig. 4). Similar observations have been reported by Martins et al. (2010) who indicated that from the 97 patients evaluated, 53 were identified as oral Candida carriers: 81.1% were females.
Prevalence of Candida albicans (n=43), and 18.9% males (n=10). There was no association between C. albicans or NCAC species carriage within gender (P=0.7). Muadcheingk & Tantivitayakl (2015) found that the distribution of C. albicans and non-albicans Candida species isolated from oral candidiasis patients relation to gender was in females 108 isolates Candida albicans species and 66 isolates Non-albicans Candida species, while in males, it was 46 isolates Candida albicans species and 30 isolates Non-albicans Candida species.

However, our result is different from that reported by Sasikumar (2016) who noted that among 69 males, 14 were positive for C. albicans (20.30%) and 55 were negative for C. albicans (79.7%). Among 39 females, 6 were positive for C. albicans (15.4%) and 33 were negative for C albicans (84.6%). The results showed that the presence of C. albicans among males and females was not significant with (P= 0.528).

![Incidence of Oral Infection in Relation to Sex of Patients](image)

**Figure (4):** Incidence of Oral Infection in Relation to Sex of Patients.

### 3.2.3. Incidence of Oral Candidiasis in Relation to Age Patients:

The results of Candida albicans infection have indicated that the age group between 20-26 years is more susceptible and occurs in 17.8% of total Candida albicans infection cases, followed by age group of 55-61 years that appears in each 15.8%, and the rest ages between 34-40 and 48-54 years appear in each 14.9%, whereas age group 27-33 years appears in 10.9%, and age groups between 13-19 and 41-47 years are represented by 7.9%, and age group 62-68 years appear 6.9%, respectively. On the other hand, the age
group less than 12 years and more than 69 years are less susceptible (Fig. 5). Results of chi-square test from figure (5) have shown that there is a statistically significant association between different age groups of dental patients and Candida albicans infections (P<0.01) The current results are basically similar to those obtained by Al-Kebsi et al. (2017) who noticed that the results of Candida albicans indicate that the age was ranged from 20 – 27 years, with mean age ± SD equal to 22.1±2.1 years for female samples, and for male samples the mean age ± SD was 23.4±2.3 years. Most of the samples were in age group 20-22 years (43%) and in age groups 22-25 years were 32.8%, and samples in age group ≥ 26 years count only 24.2% of the total.

![Graph showing the incidence of Oral Candidosis in Relation to Age of Patients.](image)

**Fig. (5): Incidence of Oral Candidosis in Relation to Age of Patients.**

Our result is different from that reported from Philadelphia by Bouquot et al. (2002) in which no difference in the rate of mouth colonization by Candida albicans occurred with age, but similar to that reported from Yemen by Al-Kebsi et al. (2017) in which the highest rate occurred in 20-22 age groups.

3.2.4. **Incidence of Patients’ Education Levels in Relation to Oral Candidiasis:**

Candida albicans infection is highly appeared in illiterate level patients represented in 87.5% of the tested number, followed by university or above education and secondary education (48.5% and 46.8%) respectively, whereas 35% of basic education patients, on the other hand, patients who
hardly can read and write are in 16.7% Table (2). Results of chi-square test from table (1) shown that there is a statistically significant association between education levels of dental patients and *Candida albicans* infections (P<0.05). Our result is different from that reported by Lyon *et al.* (2006) who reported that in terms of education, the percentage of *Candida* spp. carriers with fewer than 4 years of study was high among oral candidiasis patients and was statistically significant. Thus, education can be an important factor for the carrier state, as it may determine the degree of comprehension of instructions on hygiene, especially among dental patients.

### Table (2): Incidence of Patients' Education Level in Relation to Oral Candidiasis.

<table>
<thead>
<tr>
<th>Level of education</th>
<th><em>C. albicans</em></th>
<th>Non-albicans</th>
<th>Negative cases</th>
<th>Total cases</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Illiterate</td>
<td>21</td>
<td>87.5</td>
<td>2</td>
<td>8.3</td>
<td>1</td>
</tr>
<tr>
<td>Read &amp; write</td>
<td>1</td>
<td>16.7</td>
<td>2</td>
<td>33.3</td>
<td>3</td>
</tr>
<tr>
<td>Basic ed.</td>
<td>7</td>
<td>35</td>
<td>6</td>
<td>30</td>
<td>7</td>
</tr>
<tr>
<td>Secondary ed.</td>
<td>22</td>
<td>46.8</td>
<td>16</td>
<td>34.1</td>
<td>9</td>
</tr>
<tr>
<td>University or above</td>
<td>50</td>
<td>48.5</td>
<td>25</td>
<td>24.3</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
<td></td>
<td>51</td>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>

F: frequency p value <0.05 significant.

### 3.3. Antifungal activity:

Tow antifungal drugs commonly used in oral candidiasis have been tested against the 20 isolates of *Candida albicans* in the present work. The results indicate that the susceptibility of *Candida albicans* towards fluconazole (10mcg) has been recorded to have mean inhibition zone diameter 35.6 mm, among 20 isolates, 16 (80%) isolates shown as sensitive, whereas, 4(20%) isolates appeared as resistant. Itraconazole (30mcg) was recorded to have inhibition zone mean diameter 22.4 mm, 16(80%) isolates shown as sensitive, whereas 4(20%) isolates appeared as resistant Table (3). The current results are different to those obtained by Mahmoud *et al.* (2021) who found that 76.19 % (32/42) were Fluconazole resistant. Ahmed (2019) showed that a total of 83 isolates of *Candida albicans* were analyzed for their susceptibility to fluconazole. MIC assessment showed that the isolates were susceptible to antifungal compound. Lyon *et al.* (2006) reported that, 90% of the *C. albicans* isolates were inhibited by a concentration of 2.0 μg/mL of fluconazole. Among *C. albicans* isolates obtained from dental
Prevalence of Candida albicans wearers and among the total samples, MIC 90 (concentration that inhibits 90% of the isolates tested) reached 8.0 μg/mL. In C. albicans isolates, resistance to fluconazole was observed. Itraconazole showed strong inhibition towards C. albicans isolates (MIC90 = 0.06 μg/mL).

Table (3): The Mean of Inhibition Zone of 20 Isolates of Candida albicans to Antifungal Drugs.

<table>
<thead>
<tr>
<th>Name of Drug</th>
<th>Disc Content</th>
<th>No. of Sensitive Isolates, %</th>
<th>No. of Resistant Isolates, %</th>
<th>The Mean of Inhibition Zone (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itraconazole</td>
<td>30 mcg</td>
<td>16(80%)</td>
<td>4(20%)</td>
<td>22.4± 3.8</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>10 mcg</td>
<td>16(80%)</td>
<td>4(20%)</td>
<td>35.6± 5.5</td>
</tr>
</tbody>
</table>

SD.: Stander Deviation N: number of samples

Al-Shamahy et al. (2020) reported that all Candida species isolates were resistance to fluconazole, was found in 40% of C. tropicalis and 20% in C. glabrata and 13.8% in C. albicans, who found that fluconazole showed a good performance against the C. albicans isolates studied. Similarly, results obtained by Lyon et al. (2006) who demonstrated that 100% of C. albicans strains were susceptible to fluconazole. In a study performed by Resende and Resende (1999) itraconazole was the most efficient antifungal drugs for most species of Candida and fluconazole was the least efficient. In our study, itraconazole was effective against the Candida albicans.

3.4. Plant Extracts Activity:

The antifungal activities of plant extracts (Salvadora persica and Commiphora myrrha) investigated against 20 isolates of Candida albicans in the present work, the results indicated that the susceptibility of Candida albicans towards aqueous and alcoholic plant extracts. The mean of inhibition zone of aqueous extracts of Salvadora persica toward concentration of extract (50, 100, 150, 200) mg/ml is (5, 9.4, 17, 23.1) mm in diameter, whereas the mean of inhibition zone of alcoholic extracts toward the same concentrations appeared (15, 19.9, 24.7, 30.1) mm in diameter (Fig. 6).
Figure (6): Response of 20 Candida albicans Isolates against Salvadora persica Extracts.

The current results are similar to those obtained by Noumi et al. (2010) & Aljarbou et al. (2022) who conducted to investigate the anti-candida activities of S. persica extracts. Antifungal effects are reported as inhibition zones and ‘in vitro’. The results obtained by using the disc diffusion method recorded in SDA, fresh S. persica extracts show significant antifungal activity against almost all of the tested Candida albicans strains. Overall, the best antifungal activity has been against C. albicans for dry S.persica diluted alcohol extract.

In our results the mean of inhibition zone of aqueous extracts of Commiphora myrrha toward concentration of extract (50, 100, 150, 200) mg/ml is (1, 6.05, 14.8, 20.5) mm in diameter, whereas the mean of inhibition zone of alcoholic extracts toward the same concentration appeared (15.5 21, 26.2, 31.4) mm in diameter (Fig. 7). Similer observation by Al-Abdalall (2016) found that the results showed that two types of the Myrrha (Commiphora myrrha and C. molmol) aqueous extracts inhibited all the tested microbes including C. albicans. Also, the alcoholic extract had inhibitory effect on the growth of three pathogenic tested isolates including C. albicans. By performing the chemical analysis for the Myrrha, it was noted that it contains three components known for their antimicrobial effect. Abdallah et al. (2009) & Al Ahmadi (2006) stated that the Commiphora resins are rich in furanosesquiterpenoids compounds in a total number of 20
different compounds from such type. The separated compounds extracts of Commiphora resin have showed activity that resists the fungi.

Figure (7): Response of 20 Candida albicans Isolates against Commiphora myrrha Extracts.

CONCLUSION

The prevalence of Candida albicans in the oral cavity among dental patients was evaluated in 200 patients. Among the examined specimens 152 sample (76% of total specimens), have oral candidiasis by Candida albicans and non-Albicans species. Among the positive oral candidiasis, 101 (50.5% of total specimens) are infected by Candida albicans. Whereas 51(25.5% of total specimens) are infected by non-Albicans species. While the remaining specimens 48(24%) have shown no yeast growth (negative cases). Candida albicans infection have indicated that the female patients are highly than of male patients. This has occurred in 56.4% of female, and 43.6% of male patients. The highest incidence of C. albicans was in the age group (20-26) years, while less than 12 years (children) and more than 69 years are less susceptible were least infected. Candida albicans infection are highly appeared in illiterate level patients, on the other hand, patients who hardly can read and write were least infected. The antifungal drugs (Fluconazole and Itraconazole), examined in vitro, show antifungal sensitivity that shows (80%). All the concentration of alcoholic extracts for investigated plants (Salvadora persica and Commiphora myrrha) show antifungal activity in vitro better than aqueous extracts.
REFERENCES


Prevalence of Candida albicans.


