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Factors Predisposing to Oral Candidiasis Infection among Dental Clinic Patients in Taiz City, Yemen

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العوامل المهيئة لإصابات المبيضات البيضاء بين مرضى عيادات الاسنان في مدينة تعز، اليمن

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الملخص

الخلفية العلمية: داء المبيضات الفموي هو عدوى انتهازية سطحية لتجويف الفم بواسطة فطر المبيضات البيضاء. العوامل الموضعية والجهازية تسهل تطور المرض. **الهدف من الدراسة:** أجريت هذه الدراسة لتقييم العوامل المهيئة لعدوى داء المبيضات الفموي بين مرضى عيادة الأسنان في مدينة تعز، اليمن. **المنهجية:** تم استخدام تصميم دراسة مقطعية لهذا البحث. تم إجراء هذه الدراسة خلال الفترة من أكتوبر 2021 إلى يناير 2022، شمل البحث 200 حالة من مرضى عيادات الاسنان المصابين بعدوى داء المبيضات الفموي. تم أخذ التاريخ المرضي من كل مريض وتم تسجيله في الاستبيان. تم التعرف على كافة عزلات الخميرة بالفحوصات الميكروبيولوجية. **النتائج:** أظهرت الدراسة أن المرضى الذين يمضغون القات والمدخنين وماضغي التبغ الذين تم اختبارهم معرضون بشكل كبير للإصابة بالمبيضات البيضاء، وأظهرت الدراسة أن المرضى الذين يعانون من نزيف اللثة، وسوء تنظيف الأسنان، وجفاف الفم هم أكثر عرضة للإصابة بالمبيضات البيضاء. أظهرت الدراسة أن 59.8% من المرضى الذين خضعوا لتقويم الأسنان، ومرتدي أطقم الأسنان، وحشوات الأسنان والتيجان والجسور السنية، كانت نتيجة فحصهم إيجابية للمبيضات البيضاء مقارنة بـ 38.6% من المرضى ذوي الأسنان الطبيعية. أظهرت النتائج أن المرضى الذين يستخدمون أطقم الأسنان الكاملة أو الجزئية معرضون بدرجة كبيرة للإصابة بالمبيضات البيضاء بنسبة 69.5% من إجمالي عدد الذين تم فحصهم. وقد أظهرت الدراسة أن المرضى الذين يعانون من مضاعفات مرض السكري والذين يستخدمون المضادات الحيوية الذين تم اختبارهم كانت نتائجهم إيجابية بالنسبة للمبيضات البيضاء.

الكلمات المفتاحية: داء المبيضات الفموي، المبيضات البيضاء، عيادات الاسنان، تعز، اليمن.

Factors Predisposing to Oral Candidiasis Infection among Dental Clinic Patients in Taiz City, Yemen

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Abstract

Background: Oral candidiasis is a superficial opportunistic infection of the oral cavity by *Candida albicans*. Local and systemic factors facilitating the development of the disease. **Objective:** The present study was done to evaluate the predisposing factors to oral candidiasis infection among dental clinic patients in Taiz city, Yemen. **Methods:** A cross-sectional study design was used for this research. This study has been carried during October 2021 to January 2022, including 200 outpatient cases with oral candidiasis infection. A history was taken from each patient was recorded in questionnaire. All yeast isolated identified by mycological examination. **Results:** the study shows that patients are qat chewers, smokers, and tobacco chewing patients tested are high susceptible to *Candida albicans* infection, the study shows that patients are gingival bleeding, bad cleaning of tooth, dry mouth tested are high susceptible to *Candida albicans* infection. The study shows that 59.8% of patients with orthodontics, denture wearers, dental filling and dental crown tested positive for *C. albicans* compared to 38.6% of patients with natural teeth. The results have revealed that the patients with the full or partial dentures are highly susceptible for *Candida albicans*, represented in 69.5 % of total number of the tested. The study has showed that the patients complicating diabetes and using of antibiotics tested are positive for *C. albicans.*

Keywords: Oral candidiasis, *Candida albicans*, Dental clinic, Taiz, Yemen.

1. Introduction

Oral candidiasis (also called candidiasis) is an opportunistic infection affecting the oral mucosa. These lesions are very common and caused by yeast *Candida albicans*. *C. albicans* are normal commensal of oral microflora and more than 30% of individuals carry these organisms. The rate of carriage increases with advancing age of the patient and *C. albicans* has been recovered from oral cavity of most of the adults with bad oral hygiene (Terezhalmy and Huber 2011; & Prasanna 2012). It is one of the common fungal infections, 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).

Factors that predispose oral candidiasis, according to Al-Kebsi *et al*. (2017), the highest percent of infection with oral thrush disease within the different age groups, in patients with diabetes mellitus, decreased salivation and concomitant reduction in pH. Other factors which help oral colonization of *Candida sp*, include higher oral *Candida* carriage rate in sex (female), smoking, denture wearing, dental bridge, orthodontics, and previous antibiotics users. In addition, medications could also contribute predispose oral candidosis are antimicrobials, including excessive use of antibacterial mouthwashes and antibiotics. Moreover, local factors could also predispose oral candidosis that include irritation from ill-fitting dentures and poor oral hygiene. (Farah *et al*. 2000). However, there are not enough studies to the predisposing factors that exist in Yemeni society, such as qat and chewing of tobacco. For this reason, there is a need to study the factors predisposing the occurrence of oral candidosis, such as qat intake, smoking, chewing tobacco, factors indicative of oral health (mouth odor, dry mouth and oral hygiene), and diseases that increase risk factors (diabetes, and some wrong practices in the community such as excessive use of antibiotics).

Factors that predispose to oral candidiasis relate primarily to the host. There are some factors that predispose to oral candidiasis including drug therapy, especially broad-spectrum antibiotics, immuno modulatory and xerogenic medications, blood dyscrasias and malignancy, dietary factors, endocrine disorders, immunologic disorders and salivary changes (Farah *et al*. 2000). Drug therapy, including broad-spectrum antibiotics, immuno

modulatory medications and cytotoxic medications, alters the host susceptibility, resulting in oral candidiasis (Cannon *et al*. 1995). Individuals with diabetes were found to have higher *Candida* carriage rate than the non-diabetics, presumably due to increased *Candida* growth with high glucose levels in saliva and decreased pH (Soysa & Ellepola. 2005). Local factors that promote oral candidiasis and predispose to oral candidiasis include irritation from ill-fitting dentures and poor oral hygiene (Farah *et al*. 2000). Poor denture hygiene such as wearing the dentures continuously without taking them out at night and poor denture cleanliness predisposes the individuals to denture-related oral candidiasis (Zomorodian *et al*. 2011; & Chopde *et al*. 2012).

In the oral cavity, *Candida* can adhere to the oral epithelial cells, saliva molecules and teeth. They also adhere to the inert polymers of dental prostheses and other oral microorganisms. Co-adherence of *C. albicans* with several oral bacteria as *Streptococcus gordonii, Streptococcus mutans, Streptococcus oralis, Streptococcus sanguis, Streptococcus salivarius* and *Actinomyces* species. *C. albicans* adheres to absorbed saliva molecules (saliva pellicles) using specific adhesins that recognise cryptitopes (cryptic receptors) to promote colonization and prevent saliva-mediated aggregation and clearance from the oral cavity (Ergun *et al*. 2010).

The aim of the study:

The present study was done to evaluate the predisposing factors to oral candidiasis infection among dental clinic patients in Taiz city, Yemen.

2. Materials & Methods

2.1. Clinical diagnosis and Sampling

A cross-sectional study design was used for this research. 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 (92 males and 108 females), admitted to several dental clinics in Taiz city, Yemen, with age ranged from 7 to 71 years. A history was taken from each patient included in the study in which the finding was recorded in questionnaire. Sample size (n = 200) was determined using the Fischer formula ($n = z^2 pq/d^2$) (Fisher *et al*. 1991). Specimens of oral candidiasis have been collected from patients by using salivary samples that have been collected by using the oral rinse technique.

The samples were immediately transported to the microbiology laboratory. (Coulter *et al*. 1993).

2.2. Identification of Process

The mycological identification was based on macroscopic and microscopic examination of the culture isolates and culturing on Sabouraud dextrose agar plates (SDA), Hypertonic Sabouraud Agar, and tested for abilities to growth on SDA at 45 °C and monitoring daily for 10 dayes. (Emmons *et al*. 1977; Pinjon *et al*. 1998; Alves *et al*. 2002; Kidd *et al*. 2016; & Campbell *et al*. 2013).

2.3. Data Analysis:

The information collected from questionnaire was documented and tabulated. The data in this study was statistically analyzed using chi-square test. The statistical analysis was done using SPSS software version 21, p value < 0.05 was considered significant.

3. Results & Discussion

3.1. Effect of Qat Chewing:

In the current samples, 132 (66% of total dental patients), are qat chewers, and 68 (34% of total dental patients), are non–qat chewers. Among 132 qat chewers 75 (56.8% of total qat chewers patients), tested positive for *Candida albicans*, 57(43.2% of total qat chewers) are negative for *Candida albicans* (Fig. 1). Among total 101 patients infected by *Candida albicans*, 75(74.3%) are qat chewers. Among 68 non–qat chewers tested, positive for *Candida albicans*, 26 (38.2% of total non-qat chewers), and 42 (61.8% of total non-qat chewers) are negative for *Candida albicans*. Among total 101 patients infected by *Candida albicans* 26(38.2%) are non-qat chewers (Fig. 1).

With regards to non-albicans infection cases, 38(28.8% of total qat chewers) are positive for non-albicans species, 13(19.1% of total non- qat chewers), positive for non-albicans species. The study has demonstrated statistically significant (p= 0.013) correlations between qat chewers patients and *C. albicans* (Fig. 1).

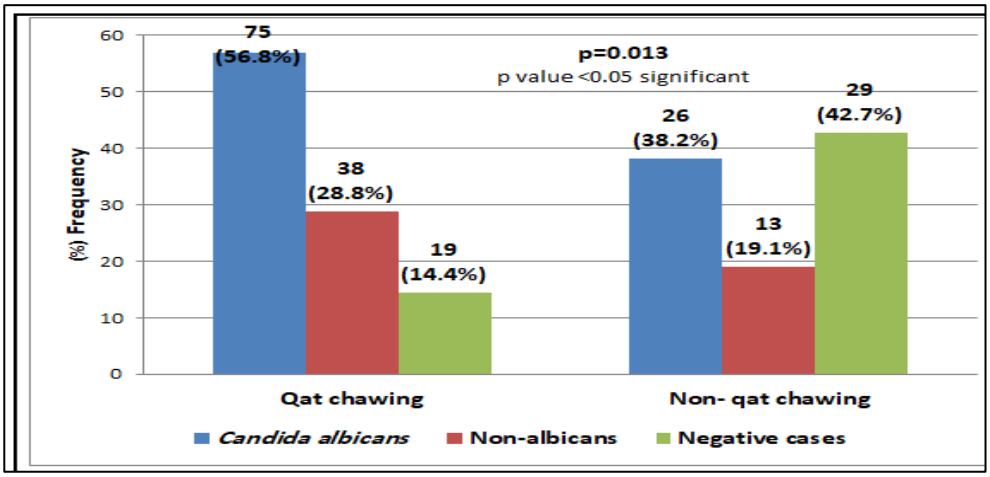

Fig. (1) Effect of Qat Chewers

The current results are basically similar to these obtained by Al-hebshi (2005); Albarmaqi et al. (2021); and Ali Quadri & Mohan. (2022). The studies showed that Qat is associated with several oral and dental conditions, as xerostomia. Other cause for colonization of *C. albicans* in Qat chewers patients is that loose, poorly oral hygiene that may also cause minor trauma to the mucosa, which is thought to enhance the permeability of the mucosa and increase the ability of *C. albicans* to invade the tissues. Torres et al. (2002) found high *Candida* counts and multiple *Candida* species in subjects with xerostomia.

There is a limited research that studied the effect of qat on the prevalence of *Candida albicans* infections of the mouth among qat chewers in Yemen, but through the previous studies above and through the present results of this research, we believe that chewing qat is likely a predisposing factor for infection with *Candida albicans* due to dry mouth resulting from the use of the qat plant. In addition to the minor trauma to the mucosa that can be caused by the qat plant among users, which creates a suitable environment for *Candida albicans* to invade the oral tissues.

3. 2. Effect of Tobacco Smoking:

In the current samples, 85(42.5% of total dental patients) are smokers and 115 (57.5% of total dental patients) are non-smokers (Fig. 2). Among 85 smoking patients 54(63.5%), tested positive for *C.albicans*, 31(36.5%) tested negative for *C.albicans* (Fig. 2). Among 115 non-smokers patients 47

(40.9%) tested positive for *C.albicans*, 68(59.1%) tested negative for *C.albicans* (Fig. 2). The study shows that 63.5% smokers tested positive for *C.albicans* compared to 40.9% of non-smokers (Fig. 2). The result shows a statistically significant differences p=0.002 (P<0.05) when comparing tobacco smoking status with *C.albicans* positive infections (Fig. 2).

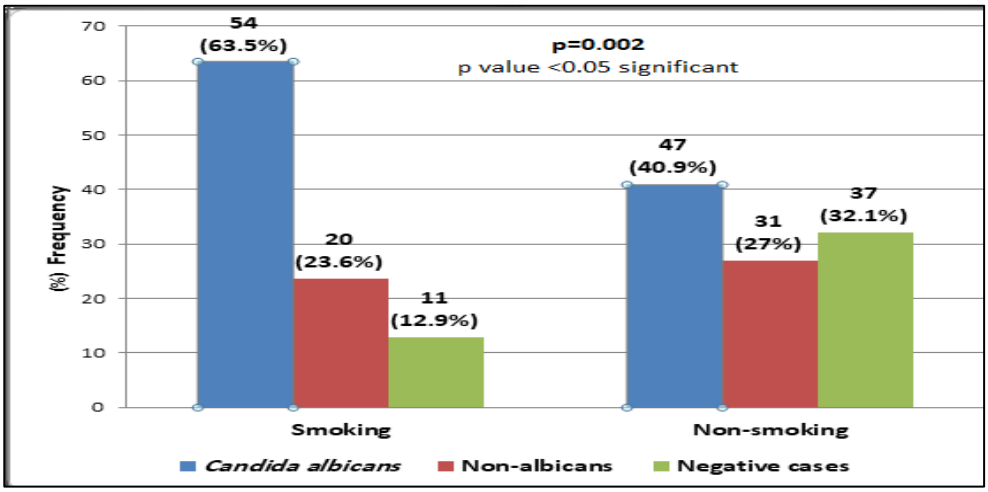

Figure (2) Effect of Tobacco Smoking

Similar observations have been reported by Bouquot and Schroeder (1992). It has been shown that the great majority (83%) of oral candidiasis patients are moderate to heavy cigarette smokers. The rate of oral *Candida* carriage can be variably affected by smoking, becoming either more or less intense in different individuals. However, the mechanism of the effect of cigarette smoke on oral *Candida* is controversial, (Soysa & Ellepola. 2005). Muzurovi´c *et al*. (2013) showed that smoking has an influence on oral colonisation with *Candida* species. Cigarette smoke affects saliva, and oral microbiota, including *Candida*. This result is in accordance with the study done by Keten *et al*. (2015) in Turkey that showed that 30% of the study samples were *C. albicans* positive in smokers compared to 18.3% non-smokers. Similarly, tobacco users were found to harbour elevated levels of *C. albicans*. (Sheth *et al*. 2016). Williams *et al*. (2021) who found that among the subjects who tested positive, *C. albicans* was significantly higher in the 9 out of 29 smokers (31%) than in the 11 out of 79 non-smokers (13.0%) with (p=0.042), showing that tobacco smoking increases the prevalence of *C. albicans*.

However, other studies found that tobacco smoking did not have an influence on oral colonization with *C. albicans,* Oliver & Shillitoe (1984) in California USA showed that *C. albicans* to be prevalent in 35% smokers and in 35% non-smokers. Darwazeh *et al*. (2010) isolated *C. albicans* from 84% of the smokers and 74% of the non-smokers and they found no significant association between smoking habits and *C. albicans*. He found that tobacco smoking did not appear to increase oral colonization with *Candida* species in healthy subjects.

3. 3. Effect of Tobacco Chewers:

In the current samples, 44 (22% of total dental patients) are tobacco chewers and 156 (78 % of total dental patients) are non-tobacco chewers. Among 44 tobacco chewers patients 28(63.6%), tested positive for *C. albicans,* 16(36.4%) tested negative for *C. albicans* (Fig.3). Among 156 non-tobacco chewers patients 73 (46.8%) tested positive for *C. albicans*, 83(53.2%) tested negative for *C. albicans* (Fig.3). The study shows that 63.6% tobacco chewers patients tested positive for *C. albicans* compared to 46.8% of non-tobacco chewers patients. The result shows a statistically significant differences $p=0.034$ ($P<0.05$) when comparing tobacco chewers status with *C. albicans* positive infections (Fig.3).

The current results are similar to those obtained by Muzurović *et al.* (2013), and Keten *et al*. (2015) that found a significant risk factor for increased oral *Candida* carriage is habitual tobacco usage (tobacco chewing). Hsia *et al.* (1981) noticed that one possible reason for this is that chemicals in tobacco, such as nicotine, nitrosodietheinal amine and aromatic hydrocarbons, act as sources of nutrition for *Candida* species, thus facilitating their growth.

The present results are different from that obtained by Parmar *et al.* (2017) who studied assessing salivary flow rate, salivary pH and oral candidiasis among tobacco chewers. He found that, there was no significant association between tobacco habits and oral candidiasis (p value = 0.129), and conclude tobacco use as chewing form reducing the salivary flow rate and pH, and there was no significant association between oral candidiasis and tobacco habits.

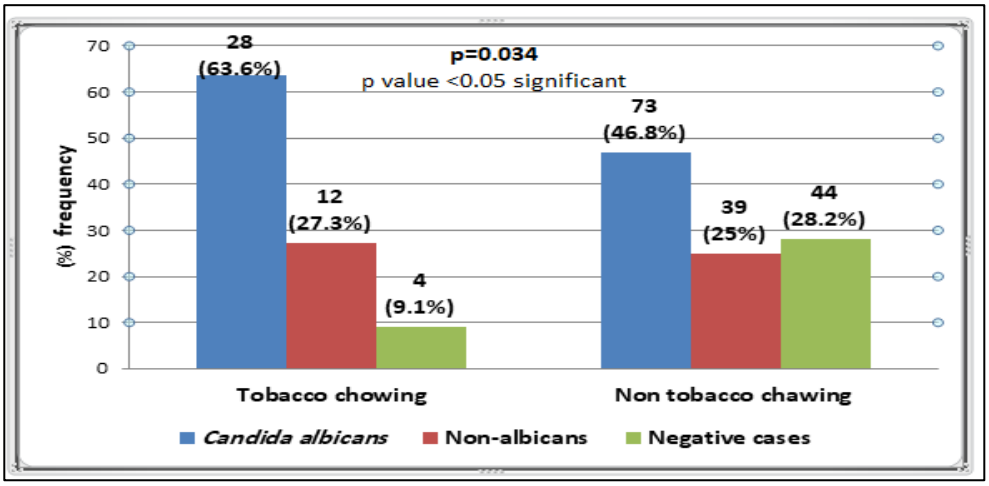

Fig. (3) Effect of Tobacco Chewers

3.4 . Effect of Gingival Bleeding:

In the current samples, 83 (41.5% of total dental patients) were complicating gingival bleeding and 117(58.5 %) are non-complicating gingival bleeding (Table 1). Among 83 patients complicating gingival bleeding 49(59%), tested positive for *C. albicans*, 34 (41%) tested negative for *C. albicans*. Among 117 non-complicating gingival bleeding patients 52 (44.4%) tested positive for *C. albicans*, 65 (55.6%) tested negative for *C.albicans* (Table 1).

The study shows that 59% of complicating gingival bleeding patients tested positive for *C. albicans* compared to 44.4% of non-complicating gingival bleeding patients. The result shows a statistically significant differences p=0.042 (P<0.05) when comparing gingival bleeding patients with *C. albicans* positive infections (Table 1).

Table (1) Effect of gingival bleeding

Gingival bleeding	*Candida albicans*		Non-albicans		Negative cases		Total cases		p-value
	F	%	F	%	F	%	F	%	
Yes	49	59	25	30.1	9	10.9	83	41.5	0.042
No	52	44.4	26	22.2	39	33.4	117	58.5	
Total	101		51		48		200		

F: frequency p value <0.05 significant

Fanello *et al*. (2006) reported that the gingival inflammation was also characterized by the presence of bleeding from probed gingival sulcus.

Carrilho Neto *et al*. (2011) noticed that gingival inflammation was found in 41 (74.5%) patients. He found that the gingival inflammation was associated with a number of diseases and daily medications.

Through previous research, we find that bleeding gums is common in dental patients due to oral diseases or as a result of dental treatments or sometimes because of dentures. The presence of blood is likely to be an encouraging factor for *Candida albicans* to grow and cause infection with the availability of wounds in the oral membranes, but this hypothesis needs more investigative research.

3.5 . Effect of Tooth Clean Daily:

Among 200 total patients,77 (38.5% of total dental patients) are cleaning tooth daily and 123(61.5% of total dental patients) are not cleaning tooth daily, The results indicate that during 77 patients are cleaning tooth daily 30 (39% of total patients cleaning tooth daily) tested positive for *Candida albicans*, 47 (61%) tested negative for *Candida albicans*. Among 123 patients who are not cleaning tooth daily 71 (57.7% of total patients of no cleaning tooth daily) tested positive for *Candida albicans*, 52(42.3%) tested negative for *Candida albicans* are represented in table (2).

The study shows that 39% of patients cleaning tooth daily tested positive for *C. albicans* compared to 57.7% of patients who are not cleaning tooth daily. The result shows no statistically significant differences p=0.949 (P>0.05) when comparing cleaning tooth daily patients with *C. albicans* positive infections (Table 2).

Table (2) Effect of Tooth Clean Daily

Tooth clean	*Candida albicans*		Non-albicans		Negative cases		Total cases		p-value
	F	%	F	%	F	%	F	%	
Yes	30	39	14	18.1	33	42.9	77	38.5	0.949
No	71	57.7	37	30.1	15	12. 2	123	61.5	
Total	101		51		48		200	100	

F: frequency p value >0.05 not significant

The present result agree with several clinical investigations that were performed to study the presence of a possible relationship between *Candida* colonization status and good oral hygiene as Alrayyes *et al*. (2019) that studied the correlation between oral/dental hygiene and *Candida* carriage, and

he show that the oral carriage rate and concentration of *Candida spp*. among those who brushed or used mouth wash on a regular basis was comparable, but not significantly different.

Sanz-Orrio-Soler *et al*. (2020) noticed that the level of hygiene influence its occurrence, but according to the systematic review carried out, it is important not only to brush teeth, but also to brush the tongue, gums and mucous membrane. It is also important to maintain strict hygiene practices in order to avoid the accumulation of *Candida* species.

However, the present result is different from that one reported by Adachi *et al.* (2007); Darwazeh *et al.* (2010); & Pellizzaro *et al*. (2012). In these studies, researchers observed no relationship between good oral hygiene and reduced carriage rate of the count of colonizing cells of *Candida spp*.

3.6. Effect of Dry Mouth:

A total of 200 sample patients has been collected from dental patients, 107 (53.5% of total dental patients) are complicating dry mouth and 93 (46.5 % of total dental patients) are non-complicating dry mouth (Table 3). Among 107 patients complicating dry mouth 71(66.4%), are tested positive for *C. albicans*, 36 (33.6%) tested negative for *C. albicans* (Table 3).

Among 93 patients not complicating dry mouth patients 30 (32.3%) tested positive for *C. albicans*, 63 (67.7%) tested negative for *C. albicans* (Table 3).

The study shows that 66.4% of patients complicating dry mouth tested positive for *C. albicans* compared to 32.3% of patients no complicating dry mouth patients. The result shows a statistically significant differences $p<0.001$ ($P<0.05$) when comparing dry mouth patients with *C. albicans* positive infections (Table 3).

Table (3) Effect of Dry Mouth

Dry mouth	*Candida albicans*		Non-albicans		Negative cases		Total cases		p-value
	F	%	F	%	F	%	F	%	
Yes	71	66.4	24	22.4	12	11.2	107	53.5	<0.001
No	30	32.3	27	29	36	38.7	93	46.5	
Total	101		51		48		200	100	

F: frequency p value <0.05 significant

The current results agree basically with those obtained by Cannon and Chaffin (2001) who found that the flushing effect of saliva and anti-candida salivary components such as lysozyme, histatins, lactoferrin, and calprotectin are the innate host defenses which act to remove or kill invading yeasts. Torres *et al*. (2003) and Buranarom *et al*. (2020) reported that the low salivary flow rate causes increase oral cavity colonization by *C. albicans* and other yeasts.

The present result is different from that study reported by Navazesh *et al*. (1995) who found that the results of this study revealed a significant negative correlation between whole saliva flow rates and *Candida albicans* counts in persons with dry mouth. The whole saliva also was a better predictor in identifying persons with high *Candida* counts.

3.7. Patients with Orthodontics, Denture Wearers, Dental Filling and Dental crown Comparing to Patients with Natural Teeth:

A total of 200 sample patients has been collected from dental patients, 112 (56 % of total dental patients) are patients with orthodontics, denture wearers, dental filling, dental prosthesis and 88 (44 % of total dental patients) are patients with natural teeth. Among 112 patients with orthodontics, denture wearers, dental filling and dental prosthesis 67(59.8%), are tested positive for *C. albicans*, whereas, 45(40.2%) tested negative for *C. albicans* (Table 4). Among 88 patients with natural teeth 34 (38.6%) tested positive for *C. albicans*, 54(61.4%) tested negative for *C. albicans*. The study shows that 59.8% of patients with orthodontics, denture wearers, dental filling and dental prosthesis tested positive for *C. albicans* compared to 38.6% of patients with natural teeth. The result shows a statistically significant differences $p=0.015$ ($P<0.05$) when comparing orthodontics, denture wearers, dental filling and dental prosthesis status with *C. albicans* positive infections (Table 4).

The results revealed that the patients with the full or partial dentures are highly susceptible for *Candida albicans*, represented in 69.5% No. of tested, the patients with dental crown occur in 68.8% number of the tested infected by *Candida albicans*, followed by patients with dental filling appeared in 52.5%, whereas, 50 % of orthodontics patients infected by *Candida albicans* (Table 4).

Table (4) Patients with Orthodontics, Denture Wearers, Dental Filling and Dental crown Comparing to Patients with Natural Teeth:

Type	*Candida albicans*		Non-albicans		Negative cases		Total cases		p-value
	F	%	F	%	F	%	F	%	
Orthodontics	10	50	5	25	5	25	20	17.9	0.015
Denture wearers	25	69.5	8	22.2	3	8.3	36	32.1	
Dental filling	21	52.5	10	25	9	22.5	40	35.7	
Dental crown	11	68.8	4	25	1	6.2	16	14.3	
Total – cumulative %	67	59.8	27	24.1	18	16.1	112	56	
Patients with natural teeth	34	38.6	24	27.3	30	34.1	88	44	
Cumulative total	101		51		48		200	100	

F: frequency p value <0.05 significant

The current results are basically similar to these obtained by Zomorodian et al. (2011), and Chopde et al. (2012) who reported that oral prostheses, such as removable partial and full dentures and prostheses placed after corrective surgeries, are known to be risky factors for *Candida* colonization and hence development of oral infections. In total, 60% to 100% of denture wearers carry *Candida* in their oral cavity. In addition, high numbers of Candida counts have been found in the oral cavities of denture wearers compared to non-wearers (Gusmão et al. 2011; and Mothibe, & Patel 2017). Dentures decrease the flow of oxygen and saliva to the underlying tissues, creating an acidic, anaerobic environment, which is conducive to *Candida* growth. In addition, surface characteristics: porosity and hydrophobicity of denture acrylic and the denture lining allow adhesion of *Candida* (Dantas et al.2014; and Sampaio-Maia et al.2012).

In Lyon et al. (2006) the percentage of *Candida spp*. carriers among denture wearers was 64.2%, while among individuals with natural teeth this percentage was 19.2%. This difference was statistically significant ($p < 0.001$) concluding that the use of prosthetic devices was confirmed as a predisposing factor for the presence of *Candida spp*. In the oral cavity.

Barbeau et al. (2003) observed the presence of *Candida spp*. in 45% of the denture wearers assayed. Kleinegger et al. (2001) reported that 60% of healthy individuals with natural teeth were *Candida spp*. carriers. According to Budtz-Jörgensen et al. (2000), the mean percentage of healthy individuals that carry *Candida spp*. is 34%. Odds. (1988) observed that the mean prevalence of yeasts in saliva of healthy subjects was 35%. This mean prevalence rises to 85% in denture wearers with normal palatal mucosa. The incidence of positive counts of yeasts depends on the isolation technique and the number of samples. Thus, it is difficult to compare the results of different researchers.

The present result is different from that reported by Sanz-Orrio-Soler et al. (2020) who reported that no statistically significant increase in *C. albicans* colonization was observed during the orthodontic treatment. The fixed appliances had no influence on the presence, absence or level of colonization by *C. albicans* and there were no significant differences between the different appliances studied.

3. 8. Effect of Diabetic Diseases:

In the current samples, 67 (33.5% of total dental patients) are complicating of diabetes and 133 (66.5 % of total dental patients) were no complicating diabetes (Fig. 4). Among 67 patient complicating diabetes 56 (83.6%) are tested positive for *C. albicans*, 11(16.4%) tested negative for *C. albicans* (Fig. 4).

Among 133 no complicating diabetes patients 45 (33.8%) are tested positive for *C. albicans*, 88(66.2%) tested negative for *C. albicans* (Fig. 4).

The study shows that 83.6% of patients complicating diabetes tested positive for *C. albicans* compared to 33.8% of patients no complicating diabetes. The result shows a statistically significant differences $p<0.001$ ($P<0.05$) when comparing diabetes tested with *C. albicans* positive infections (Fig. 4).

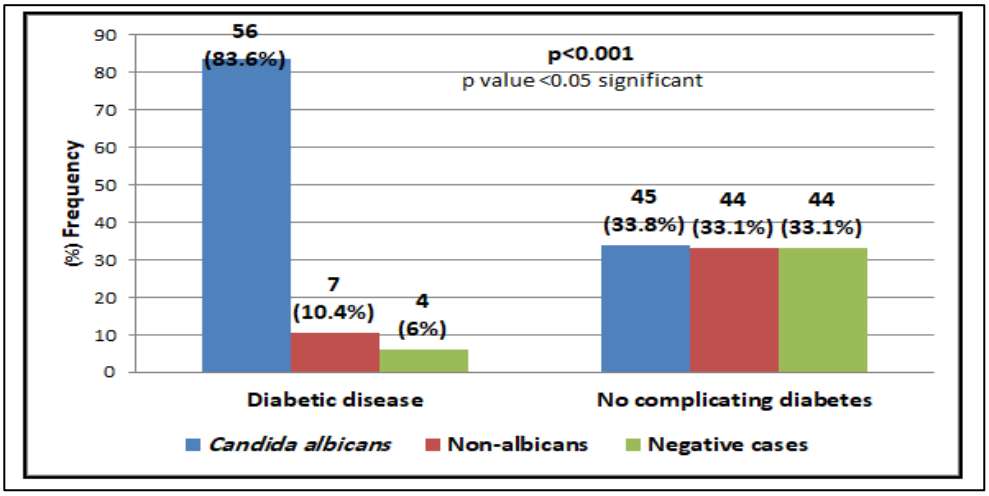

Fig. (4) Effect of Diabetic Diseases

The role of *Candida* species as a precursor of disease among diabetic patients was first described by Odds *et al*. (1978) who observed a higher rate of oral candidiasis in patients with diabetes mellitus (DM) than in healthy individuals (Khosravi *et al*. 2008). The present result is similar to that reported by Alrayyes *et al* (2019) who found that the prevalence of oral carriage rate of *Candida* was comparable between diabetic participants and non-diabetic participants [4/45 (8.9%) versus 41/45 (91.1%) respectively; P = 0.23], nevertheless, the mean carriage concentration of *Candida* was significantly higher among diabetic participants than their non-diabetic counterparts 4492 (SD ± 5629) versus 293 (SD ± 634) P ≤ 0.00.

However, another study has contradicted this relationship between DM and oral colonization by *Candida*. (Bremenkamp *et al*. 2011). The present results showed a significantly ($p<0.001$) higher *Candida albicans* among diabetics than non-diabetics. Although, these findings are consistent with some previous investigations. Diabetics had a higher candidal carriage rate compared to controls, but not density. *Candida albicans* was the most frequently isolated species, but diabetics had a variety of other candidal species present (Al-Attas & Amro.2010).

3. 9. Effect of Using of Antibiotics:

In the current samples, 93 (46.5% of total dental patients) there are patients using of antibiotics and in 107 (53.5 % of total dental patients), there are

patients who are not using of antibiotics table (5). Among 93 patients using of antibiotics 61(65.6%), tested positive for *C. albicans*, 32(34.4%) tested negative for *C. albicans* table (5).

Among 107 patients, not using of antibiotics, 40 (37.4%) tested positive for *C. albicans*, whereas 67(62.6%) tested negative for *C. albicans* table (5).

The study shows that 65.6% of patients who are not using of antibiotics tested positive for *C. albicans* compared to 37.4% of patients who are not using antibiotics. The result shows a statistically significant differences $p<0.001$ ($P<0.05$) when comparing using of antibiotics with *C. albicans* positive infections (Table 5).

Table (5) Effect of Using Antibiotics

Using antibiotics	*Candida albicans*		Non-albicans		Negative cases		Total cases		p-value
	F	%	F	%	F	%	F	%	
Yes	61	65.6	25	26.9	7	7.5	93	46.5	<0.001
No	40	37.4	26	24.3	41	38.3	107	53.5	
Total	101		51		48		200	100	

F: frequency p value <0.05 significant

Similar observations have been reported by Lyon *et al. (*2006) who found that the use of certain medicines can be a predisposing factor for the presence of *Candida* spp. broad-spectrum antibiotic drugs favor growth of these microorganisms by altering the normal microbiota. Antibiotics have been identified as a major responsible factor for the development of chronic candidiasis. Since its mode of action is based on the elimination of normal flora, responsible for preventing the growth of yeasts and other pathogenic organisms, as well as suppressing the immune system, antibiotics action result in a *C. albicans* overgrowth. This situation becomes shortly a vicious cycle: A person with an alteration of the immune system is more susceptible to infections, and consequently, more infections will appear increasing the doses and frequency in the consumption of antibiotics. This fact not only favors the overgrowth of *C. albicans* and other yeasts, which increasingly develop mechanisms of resistance against antibiotics corresponding with (Murray & Pizzorno 1998; Eggimann *et al*. 2005; Sobel 2007; & Blanco & Garcia 2008).

Conclusion

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). About the effect of habitat factors among dental patients, the study shows that patients are qat chewers, smokers, and tobacco chewing patients tested are high susceptible to *Candida albicans* infection. About the effect of oral Lesion and oral hygiene among dental patients, the study shows that patients are gingival bleeding, bad cleaning of tooth, dry mouth tested are high susceptible to *Candida albicans* infection. The study shows that 59.8% of patients with orthodontics, denture wearers, dental filling and dental crown tested positive for *C. albicans* compared to 38.6% of patients with natural teeth. The results have revealed that the patients with the full or partial dentures are highly susceptible for *Candida albicans*, represented in 69.5 % of total number of the tested. The study has showed that the patients complicating diabetes and using of antibiotics tested are positive for *C. albicans.*

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