

**Prevalence of oral candida albicans among population of Jordanian denture wearer**

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**Abstract**

This study investigated the prevalence of oral candida albicans among denture wearer and its relation between candida albicans and Diabetes mellitus type II, oral hygiene, sleeping with dentures and smoking. 60 participants (36 men, 24 women) who had been using removable complete dentures for a minimum of 2 years aged between 48–86 years. Type 2 diabetes was present in 23 (38.3%) participants, while 37 (61.7%) participants did not have diabetes.

Candida albicans was isolated from 33 (55%) patients: 21 men, 12 women; 16 patients with diabetes, 17

patients without diabetes; 12 patients with poor oral hygiene, 15 patients with average oral hygiene, and 6 patients with good oral hygiene; 11 patients who always slept with their dentures, 3 patients who occasionally slept with their dentures, and 19 patients who did not sleep with their dentures; 8 smokers, 25 non-smokers. Regarding Candida albicans and degree of diabetic control, as indicated by HbA1c, there was no difference between positive and negative results for Candida albicans. Similarly, the age of the dentures, oral hygiene, smoking and sleeping with denture were similar between positive and negative Candida albicans

results. No association was found between the presence of *C. albicans* and sex, presence of diabetes, oral hygiene rating, and tendency to sleep with dentures, smoking status, and age of denture or HbA1c values.

**Keywords:** *Candida albicans*; Denture wearer; Jordan.

### Introduction

The human oral cavity has a large number of microorganism species, representing approximately 700 different species including 20 candidal species. (1,2) In particular,

previous studies have shown a high incidence of *Candida* spp. isolation from the oral cavities of patients with denture stomatitis (94%) or healthy people who wear dentures (75%). (3)

*Candida* can be present in healthy hosts and is not considered harmful unless certain conditions are met, which create opportunities for virulence that causes candidiasis. (4) Oral *Candida* was reportedly found in 34.4% of healthy subjects without manifestations and in 54.7% of hospitalized subjects. (5) However, candidal infections are considered a major problem globally, particularly for people with immuno suppression. (6–12)

Different types of *Candida* that are related with both clinical and nonclinical conditions can be present on the surface of the oral cavity such as *Candida albicans*, *Candida tropicalis*, *Candida glabrata*, *Candida Parapsilosis*, *Candida stellatoidea*, *Candida krusei*, and *Candida kefyr*, but only a few cause candidiasis. (13–17) Specifically, *Candida albicans* is commonly isolated from the oral cavity.

The use of dentures changes the physiology and normal flora of the palate. The tissue contact surface of the dentures is disturbed less often, which enhances the colonization of microbes, especially acidogenic bacteria

and *Candida*. (18) Denture insertion induces plaque formation, favouring the increased population of potentially pathogenic bacteria and *Candida* spp. (19,20)

Diabetes mellitus is a chronic metabolic disorder that is becoming one of the most common chronic diseases worldwide. The increase in the number of adults with diabetes is particularly surprising; an estimated 300 million adults are expected to have diabetes by the year 2025. (21) In Jordan, there has been a significant increase in the prevalence of type 2 diabetes mellitus during the last 10 years, reaching 31.5%. (22)

Patients with diabetes have a higher prevalence of *Candida* than patients without diabetes, (23,24) and clinical manifestations of *Candida* infection occur more frequently and severely in patients with diabetes than patients without diabetes. (25–28) *Candida albicans* is one of the most common species isolated from patients with diabetes, with a prevalence of up to 80%, (23, 25, 26, 28, 29) and is the most common virulent fungal pathogen of the *Candida* species. (30)

Diabetes mellitus affects salivary composition and amount, which influences the micro-organism population in the oral cavity. Increased salivary glucose levels in patients with diabetes causes yeast growth owing to an increased number of *Candida* receptors.(31) Similarly, reducing salivary flow also increases the colonization of *Candida* and plays a role in candidiasis.(32) Furthermore, immuno suppression can occur with diabetes mellitus, which could increase the susceptibility to oral infections with *Candida* spp.(6, 7, 23 – 25, 32–34) However, the results are controversial based on contradictory results in other studies.(25 ,32–34)

In addition, the incidence of *Candida* infection is higher in people who use dentures, especially in patients with

diabetes. (28, 29, 35, 36) Owing to the increase in diabetes within the population, especially in the elderly, there has been an increased need for dentures.

Therefore, the use of dentures is becoming more common; this could increase the risk of candida infection in this population, owing to the effects in the oral cavity and altered oral mucosa in addition to systemic complications. (23, 27–29,36)

The presence of dentures decreases salivary pH and flow rate and impedes the mechanical cleaning of the soft tissue of the oral cavity. (15) This increases infective virulence and aggravates previously existing infective conditions.

The aim of present study was to investigate the prevalence of *Candida albicans* in the oral cavities of Jordanian patients wearing dentures and its relation with diabetes, Age of the denture, oral hygiene, smoking, and sleeping with dentures.

### **Materials and Methods**

The present study was approved by the Royal Medical Services ethical committee. All of the participants provided verbal and written consent for all patients and permission for the procedures, because most of them cannot read, write or both.

The study was conducted in Prince Hasheim bin Al Huss in hospital in Zarqa Jordan in 2022(Feb 2022 -May 2022) with patients who had been using removable complete dentures for at least 2 years. Patients who were previously or currently administered antibiotics, antifungal medications, steroids, or immunosuppressive drugs in the past 6 months and or who wore the same dentures for  $\geq 30$  years were excluded.

Personal (age, sex, smoking habit), medical (medication use), and dental (age of the dentures, oral hygiene, use of dentures while sleeping) histories of the patients were recorded by the prosthodontist. Oral hygiene of the

patient and denture were graded as good, average, or poor based on the prosthodontist's report depending on examination of inner side surface of denture (fitting surface), outside surface of denture and soft tissue status under and surrounding the denture.

Tissue samples were collected from the tissue-bearing area of the upper denture by scraping it with a sterile swab. The swabs were processed for microbiological examination by immersing them in 5 mL sterile 0.9% physiological saline. This was vortexed for 1 min to disperse the adhering bacteria. A loopful of the suspension was plated on Sabouraud's dextrose (SD) agar containing gentamycin (2 mg /dL) and chloramphenicol (5 mg/ dL) and incubated for 48 h at 37°C. Typical colonies suggestive of *Candida* spp. were picked up and stained by Gram's and the lactophenol blue to observe their morphology and subjected to a battery of biochemical test. Identification of *Candida* was done by studying surface growth in SD broth, Carbo hydrate assimilation test, carbo hydrate fermentation test, serum germ tube test and studying chlamydo spores formation on Corn meal agar.

All patients with diabetes underwent a glycohemoglobin (HbA1c) test.

### **Statistical analysis**

Data were entered and coded using SPSS version 17.0 (Chicago, IL, USA). Values are reported as mean  $\pm$  standard deviation. Student's t-tests were used to analyze the differences between the means, and chi square tests were used to test the associations between variables. P values  $< 0.05$  were considered statistically significant.

### **Results**

The sample consisted of 60 (36 men, 24 women) participants aged 48–86 years (mean, 67.2  $\pm$  7.8 years; men, 68.2  $\pm$  8.4 years; women, 65.6  $\pm$  6.7 years). All of

the patients used complete dentures (upper and lower arches) for at least 2 years. Type 2 diabetes was present in 23 (38.3%) participants, while 37 (61.7%) participants did not have diabetes.

Oral hygiene was rated as poor for 28.3% of the participants, average for 53.3% of the participants, and good for 18.3% of the participants. Dentures were always worn while sleeping by 18 (30%) participants, occasionally by 3 (5%) participants, and never by 39 (65%) participants. Seventeen (28.3%) participants were current smokers (Table 2).

*Candida albicans* was isolated from 33 (55%) patients (Table 1): 21 men, 12 women; 16 patients with diabetes, 12 patients with poor oral hygiene, 15 patients with average oral hygiene, and 6 patients with good oral hygiene; 11 patients who always slept with their dentures, 3 patients who occasionally slept with their dentures, and 19 patients who did not sleep with their dentures; 8 smokers, 25 non-smokers.

The presence of *Candida albicans* did not differ significantly by sex, presence of diabetes, oral hygiene rating, tendency to sleep with dentures, or smoking status ( $P > 0.05$ ; Table 3). Patients with poor oral hygiene had a prevalence of *C. albicans* of 12 patients (70.6%), patients with average oral hygiene had a prevalence of candida of 15 (46.9%), and patients with good oral hygiene a prevalence of candida of 6 patients (54.5%) ( $P > 0.05$ ). (Table 3)

Patients with positive *Candida albicans* results had been wearing dentures for a mean  $6.42 \pm 5.10$  years, compared with a mean  $6.85 \pm 6.32$  years for patients with negative *Candida albicans* results. Patients with diabetes and positive *Candida albicans* results had mean HbA1c values of  $7.14 \pm 1.77\%$ , compared with a mean value of  $7.19 \pm 1.61\%$  for patients without *Candida albicans* (Table 4).

## Discussion

In the present study, 16 of the 23 (69.6%) patients with diabetes and 17 of the 37 (45.9%) patients without diabetes had positive *Candida albicans* findings in their oral cavity; the difference between the groups was not significant. A similar trend was observed by Kadir et al. (32) and by Sahin et al. (34), who also found no significant relations in the presence of *Candida albicans* with age or sex distribution ( $p > 0.05$ ).

The use of dentures changes the physiology and normal flora of the palate. The tissue contact surface of the dentures is disturbed less often, which enhances the colonization of microbes, especially acidogenic bacteria and *Candida*. (18) Denture insertion induces plaque formation, favouring the increased population of potentially pathogenic bacteria and *Candida* spp. (19,20)

In the present study, patients with poor oral hygiene had a prevalence of candida of 70.6%, patients with average oral hygiene had a prevalence of candida of 46.9%, and patients with good oral hygiene a prevalence of candida of 54.5% ( $P > 0.05$ ); these prevalence's are higher than in the dentate population(37) but similar to the findings of Muzurovic et al, who reported positive *Candida* spp. results for 83.4% of patients with teeth and poor oral hygiene; the most frequently isolated type was *Candida albicans*. (38)

*Candida albicans* was present for 61.1% of the patients who always wore dentures while sleeping, compared with 48.7% of the patients who did not wear dentures while sleeping. However, 100% of the patients who occasionally wore dentures while sleeping had positive *Candida albicans* results; however, because of the small sample size, the generalizability of these results could not be determined.

Candida was present for 47.1% of smokers, which is a much lower proportion than the 82.5% of dentate patients who had Candida spp. growth in a previous study by Muzurović et al. (38);

the most frequently occurring type was Candida albicans. In contrast, 58.1% of non-smokers had Candida albicans present; in the study by Muzurović et al., (38) the prevalence was 17.5% for non-smokers. This considerable difference between results might be explained by the presence of teeth in the latter study.

### Conclusion

There were no statistically association was found between the presence of C albicans and sex, presence of diabetes, oral hygiene rating, tendency to sleep with dentures, smoking status,

age of denture or HbA1c values. Never the less oral hygiene role had effect on the presence of candida albicans but not statically significant which need more investigation to focused on as an important factor affecting candida albicans presence in dentures.

Data Availability, The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Table 1: distribution of Gender, Presence of candida albicans and Diabetic type II patients

	Gender		Candida		DM	
	Male	Female	+Ve	-Ve	Non- Diabetic	Diabetic
n=number	36	24	33	27	37	23
Percentage %	60%	40%	55%	45%	61.7%	38.3%

Table 2: Distubution of Habits of Oral hygiene, sleeping with dentures and smoking

	Hygiene			Sleeping			Smoking	
	Poor	Average	Good	Yes	No	Occasionally	Yes	No
n=number	17	32	11	18	39	3	17	43
Percentage %	28.3%	53.3%	18.3%	30%	65%	5%	28.3%	71.7%

Table 3: Relation between Candida albicans and Gender, DM II, Oral Hygiene, Sleeping with dentures and Smoking.

	Gender	DM II				Oral Hygiene			Sleeping with denture			Smoking	
		Male	Female	Non- Diabetic	Diabetic	Poor	Average	Good	Yes	No	Occasionally	Yes	No
Candida	+Ve	21	12	17	16	12	15	6	11	19	3	8	25
	-Ve	15	12	20	7	5	17	5	7	20	0	9	18
P value		0.525		0.074		0.283			0.187			0.437	

P Value considered significant P <0.05.

Table 4: T Student test Candida albicans with HbA1C and age denture.

	Candida	N	Mean	Std. Deviation
DM	+Ve	16	7.14	1.77
HbA1C test %	-Ve	7	7.19	1.61
Age Denture (Year)	+Ve	33	6.42	5.10
	-Ve	27	6.85	6.32