

Oral yeasts infection in children

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ABSTRACT

Objective: The study was designed to identify the yeasts which cause oral thrush in children, in addition to other sources including the teat of bottle, nipple of breast, pacifier, and vaginal swabs from mothers of newborn to detect the source of infection.

Patients and Methods: One hundred and twenty clinically diagnosed child with oral yeast infection were enrolled during this study. The clinical specimens were collected from Dec. 2012 – May 2013, and included (120) oral swabs from infected children and (60) swabs from healthy children . In addition to (46) swabs from teat of bottle feeding babies, (37) swabs from nipple of breast feeding mothers, (20) swabs from pacifier , and (17) swabs from mother's vagina of newborn. The identification process employed direct examination , culture in different media , germ tube , chlamydospore formation and API - 20 C system tests .

Results: *Candida albicans* is the main isolate from both patients and control group (90.1% ; 78.3% respectively) , and also from the other sources . Moreover , other yeasts isolated from the patients only including *Cryptococcus laurentii* (3.9%) and *Saccharomyces cerevisiae* (1%) .

Conclusions: *Candida albicans* and other yeasts were isolated from the oral lesions and other sources indicating that the infection transmitted for and back to the infected children.

Keywords: Oral yeast, infection.

الخلاصة

الأهداف: صممت هذه الدراسة لتمييز الخمائر التي تسبب السلاق الفموي عند الأطفال ومن أطفال أصحاء يمثلون مجموعة السيطرة ، بالإضافة إلى عزل الخمائر من حلمة قناني الرضاعة الاصطناعية وحلمة ثدي الأمهات المرضعات. أياً بالإضافة إلى عزلها من مهبل أمهات الأطفال حديثي الولادة .

المرضى وطرائق العمل: تضمنت الدراسة 120 طفل مصاب بالسلاق الفموي . جمعت العينات السريرية ما بين شهر كانون الأول 2012 – أيار 2013 . شملت الدراسة (120) مسحة فموية من الأطفال المصابين و (60) مسحة من أطفال أصحاء بالإضافة إلى (46) مسحة من الحلمة لقناني الرضاعة الاصطناعية و (37) مسحة من حلمة ثدي الأمهات المرضعات و (20) مسحة من اللهاية بالإضافة إلى (17) مسحة من مهبل أمهات الأطفال حديثي الولادة . تم تمييز الخمائر المعزولة بواسطة الفحص المباشر والزرع على أوساط مختلفة وكذلك فحص الأنبوب الأنتاشي والأبواغ الكلاميدية بالإضافة إلى استخدام نظام IPA - 20 C .

النتائج: كانت *Candida albicans* أهم العزلات من المصابين والأصحاء (90,1% و 78,3% بالتعاقب) وكذلك من المصادر الأخرى. كذلك عزلت خمائر أخرى من المرضى وهي (*Cryptococcus laurentii* 3%, *Saccharomyces cerevisiae* 1%).

الاستنتاج: عزل المبيضات البيضاء والخمائر الأخرى من السُّلاق الفموي والمصادر الأخرى تثبت بأن الإصابة قد تنتقل من وإلى الأطفال المصابين.

Yeast - like fungi establish a biological link with the host which guarantees their saprophytic condition by establishing an ecological equilibrium denoted "amphibiosis"¹. When this equilibrium is broken due to different endogenous and/or exogenous factors these amphibions behave as opportunistic microorganisms, eventually causing oral infections which, if unresolved, may become generalized, leading to more severe mycoses².

Oral candidiasis is a sign of impaired local or systemic defense mechanisms. Reduced saliva secretion, deficiencies of humeral or cell - mediated immunity, local mucosal diseases and the use of wide spectrum antibiotics are predisposing factors³. In the newborn, colonization usually occurs from the mothers vaginal flora or other exogenous sources⁴. Moreover, thrush occurs more frequently in bottle - fed than in breast - fed babies and the lesions not frequently spread to the pharynx and even esophagus⁵. Also, some factors alter the hosts' defenses and allows yeasts to colonize the nipple of breast feeding mothers at pathological levels such as diabetes, corticosteroids and antibiotic therapy⁶.

The development of oral candidiasis is the result of an imbalance between fungal virulence

factors and host defenses⁷. Fungal virulence factors are necessary for the transition from colonization to infection. The first step is epithelial adhesion, involving protein and glycoprotein adhesions, the second step is fungal replication and tissue invasion, based on the capabilities of filamentation of *Candida albicans*, and the secretion of phospholipase and proteases⁸.

The aim of this study to identify the yeasts which cause oral infection and to determine the source of infection and risk factors which lead to such infection.....

Materials and Methods

Patients and controls

The study included 120 child clinically diagnosed with oral thrush. The male were 59 (49.2%) and female were 61 (50.8%). The age of the studied children ranged from 2 days - 12 years.

The control group comprised of 60 healthy child. They were 29 (48.3%) males and 31 (51.7%) females. Their age ranged between 3 days - 12 years. These children were sex and age matches with the infected children. The patients and control group were interviewed and information about possible recognizable risk factors for acquisition of yeasts were recorded using a questionnaire.

Collection and processing of samples

Two hundred and forty swabs were collected during six months from December 2012 to May 2013. One hundred and twenty oral swabs were taken from children clinically diagnosed with oral thrush, 46 swabs from teat of bottle feeding babies, 37 swabs from nipple of breast feeding mothers, 20 swabs from pacifier, and 17 swabs were taken from mother vagina of newborn in the neonatal Care Units.

All the samples collected from the children admitted to Consultative Clinics and Medical wards of Ibn – Sina and Ibn – Al-Ather Teaching Hospitals, in addition to the neonatal Care Unit of Al-batool Teaching Hospital.

From the 60 apparently healthy child, the oral swabs were processed as those from the patients.

Early morning swabs in sterile containers were collected from all patients and other sources. The swabs brought to the laboratory of Microbiology Department immediately

Each swab was cultured on Sabouraud dextrose agar with P/S and brain heart infusion (BHI) blood agar, then incubated at 37°C for 2–3 days. A direct KOH mount and/or Gram stained slides were also prepared from each swab and examined immediately for the presence of yeasts.

Identification of the isolates

Germ tube test, morphology on corneal agar Tween 80 and Lactophenol mount, in addition to the commercial test API – 20 C system were used for identification of the yeast species. The

Results

The present study included 120 clinically diagnosed child with oral yeast infection. Their age ranging

between 2 days – 12 (mean $2.28 \pm$ SE 0.30) years, and were categorized into 4 age groups. The male forming 49.2% while the female were 50.8%. The higher percentage of infection appeared in infants followed by toddlers with no significant difference between the male and female. The control group included 60 healthy child who were sex (48.3% male; 51.7% female) and age (mean $2.58 \pm$ SE 0.45) years matches with the patients (Table1).

The total number of swabs collected were 240. Those which showed positive yeast isolates were 102 from oral thrush, 23 from bottle teats, 14 from breast nipples, 8 from pacifiers, and 1 from mother's vagina (Table 2).

The type of feeding of the studied children were bottle, breast, mixed, usual, and intravenous fluid (Table 3).

The risk factors recorded for the infected children were: gastroenteritis, cancer, congenital heart diseases, malnutrition, jaundice, meningitis, sepsis, and other miscellaneous factors. The higher incidence of infection were among those with gastroenteritis (39.2%), Table 4.

The types of yeasts isolated from oral lesions and those from the control group were presented in Table 5. *Candida albicans* is the main isolate from both the patients and control group (90.1% ; 78.3% respectively). The non *Candida albicans* *Candida* (NCAC) isolates from both the patients and control group respectively were : *C. tropicalis* (2%; 4.3%), *C. parapsilosis* (2% ; 4.3%) , and *C. guilliermondii* (1% ; 8.8%) respectively. *Candida luistaniae* isolated from one sample mixed with

C. parapsilosis. Moreover , Other yeasts isolated from the patients only were *Cryptococcus Laurentii* (3.9%) and *Saccharomyces cerevisiae* (1%) . *Rhodotorula rubra* and *Trichosporon*

asahii isolated from samples mixed with *C. albicans*. On the other hand , the yeasts isolated from other sources were recorded in Table 6, showing that *C. albicans* is the main isolate.

Table 1. The age and gender of the infected children and control group

Age groups (years)	Gender											
	Patients						Control					
	Total		Male		Female		Total		Male		Female	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Infants 2 day - 1 year	62	51.7	32	26.6	30	25.0	31	51.7	16	26.7	15	25.0
Toddlers >1 - 4 years	34	28.3	17	14.2	17	14.2	16	26.7	8	13.3	8	13.3
Preschool > 4 - 6 years	9	7.5	5	4.2	4	3.3	5	8.3	2	3.3	3	5.0
School > 6 - 12 years	15	12.5	5	4.2	10	8.3	8	13.3	3	5.0	5	8.3
Total	120	100.0	59	49.2	61	50.8	60	100.0	29	48.3	31	51.7

Table 2. The number of swabs collected from different sources and the positive results for the presence of yeasts

Swabs taken from	No. of samples	Positive samples
Oral thrush	120	102
Bottle teat	46	23
Breast nipple	37	14
Pacifier	20	8
Vagina	17	1
Total	240	148

Table 3. The correlation between the type of feeding and oral infection

Type of feeding	Infected children	
	No.	%
Bottle	28	23.3
Breast	19	15.8
Mixed	18	15.0
Usual feeding	52	43.4
I.V* fluid	3	2.5
Total	120	100

*I.V = intravenous

Table 4. The risk factors that predispose to oral yeast infection.

Risk factors	Infected children	
	No.	%
Gastroenteritis	47	39.2
Cancer	19	15.8
Congenital heart diseases	13	10.8
Malnutrition	10	8.4
Jaundice	7	5.8
Meningitis	7	5.8
Sepsis	6	5.0
Miscellaneous factors *	11	9.2
Total	120	100

*Miscellaneous factors : Thalacemia (1) ; Premature (2) ; Diabetes mellitus (1) ; Renal failure (2) ; Steroid therapy (4) .

Table 5. Types of yeasts isolated from patients and control group.

Type of yeasts	Isolated yeasts			
	Patients		Control	
	No.	%	No.	%
<i>C. albicans</i> *	92	90.1	18	78.3
<i>C. tropicalis</i>	2	2.0	1	4.3
<i>C. parapsilosis</i> **	2	2.0	1	4.3
<i>C. guilliermondii</i>	1	1.0	2	8.8
<i>C. luistaniae</i>			1	4.3
<i>Cr. laurentii</i>	4	3.9		
<i>S. cerevisiae</i>	1	1.0		
Total	102	100	23	100

C = *Candida* ; *Cr* = *Cryptococcus* ; *S* = *Saccharomyces*.

* 3 species mixed with other yeast: 2 with *Rodotorula rubra*, and 1 with *Trichosporon asahii*.

** one species mixed with *C. luistaniae*.

Table 6. The number and types of yeasts isolated from different sources which have a relation to the infected children.

Source of samples	Total isolates	Type of yeasts	No.
Bottle teat	23	<i>C. albicans</i>	17
		<i>C. tropicalis</i>	1
		<i>C. parapsilosis</i>	1
		<i>C. guilliermondii</i>	1
		<i>Cr. laurentii</i>	2
		<i>S. cerevisiae</i>	1
Breast nipple	14	<i>C. albicans</i>	13
		<i>C. parapsilosis</i>	1
Pacifier	8	<i>C. albicans</i>	7
		<i>C. tropicalis</i>	1
Vaginal swab	1	<i>C. albicans</i>	1

Discussion

Thrush is a fungal infection of any of the *Candida* species, also commonly referred to as a yeast infection. The oral thrush is superficial infection of

mucous membrane characterized by white adherent patches of pseudomycelium which frequently involves lesions, sores, fissures and ulcers in the mouth which could either

acute or chronic⁵. The clinical picture of the lesions in the studied patients showed white patches with severe or moderate form.

The higher percentage of infection during the study appeared in children less than one year old. This confirmed by a previous studies mentioned that oral candidiasis is more frequently encountered in infant⁹. Moreover, Nneka and Ebele (2005) reported that oral candidiasis occurred more in younger children than in older children, and there was a significant difference between them. On the other hand, we not found a difference between male and female children in being susceptible to the oral thrush as reported by other investigators⁵.

A higher percentage (23.3%) was recorded during the study among artificially fed babies than breast fed (15.8%) which is in consistent with other reports that oral thrush occur more frequently in bottle – fed than in breast – fed babies^{5,9}. Other investigators reported that neither breast nor bottle feeding favored development of oral candidiasis^{10,11}.

... All the studied cases of oral thrush have a predisposing factors mainly gastroenteritis (39.2%) followed by cancer (15.8%). Oral candidiasis is an opportunistic infection, it is expected that medically compromised patients are at greater risk for such an infection¹². Many factors can predispose certain individuals to develop oral candidiasis as reported by Gonzalez- Gravina and coworkers¹³ (2007) that oral thrush represents a serious problem for children with cancer. Other mentioned that *Candida* infection may be a complication of antibiotics therapy when sensitive organisms are destroyed or for

corticosteroid therapy when resistance to infection may be diminished¹⁴. Moreover, Rowen and coworkers¹⁵ (1994) reported that occurrence of *Candida* particularly with extremely low birth weight premature infants and poorly nourished patients¹⁶.

The main isolate among *Candida* species during the study is *Candida albicans* from both the infected children and control group (90.1% ; 78.3%) respectively. Other NCAC species isolated were *C. tropicalis* (2%;4.3%), *C. parapsilosis* (2%;4.3%), and *C. guilliermondii* (1%; 8.8%) from patients and control group respectively while one isolate of *C. lusitaniae* (4.3%) from the control group only. Furthermore, three isolates of *Candida albicans* from the patients mixed with *Rhodotorula rubra* and *Trichosporon asahii*. *Candida* species are the most common opportunistic fungal pathogen in humans and *C. albicans* being the most prevalent pathogen in mucosal and systemic infection^{17,18}. Castilho and Rocha¹⁹ (2009) reported that *C. albicans* is the most common species isolated from the oral cavity in both healthy and diseased in 60%-80% of the cases. Other species responsible for oral infection have also been identified including *C. krusei*, *C. parapsilosis*, *C. tropicalis*, and *C. guilliermondii*^{9,20,21}. The role of NCAC have become increasingly important especially in high risk patients⁴. Yeast not belonging to the genus *Candida* such as *Rhodotorula* and *Saccharomyces cerevisiae* are sometimes found in the oral cavity but these are not known to cause oral infection²².

During the study, *C. albicans* mainly and other *Candida* species isolated from the bottle teat, breast nipple, pacifier used by the infants and mother vagina of the newborn. The isolation of the same *Candida* species from oral lesion and the mentioned items indicate that the infection transmitted for and back to and from the children. Different studies reported about the source of infections. Many researchers have investigated the factors that predispose nursing mothers to nipple candidiasis although an association between oral thrush in infants and nipple candidiasis in mother has been reported^{23,24}. The infants can pass the infection to their mother during breast feeding, and the infection may then pass back and forth between mother's breast and baby's mouth²⁵. Moreover, the use of pacifier which can be a mode of inoculation and reinfection if not properly disinfected after a diagnosis of moniliasis²⁶.

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