

Detection of *Candida* spp. in Children with Diarrhea in Kirkuk Province

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Abstract

The study aims at evaluating the relation of *Candida* spp. with diarrhea in children. A cross sectional study was carried out in Kirkuk city from 15th of January 2017 to 15th of June 2017. The number of patients under study were 120 children between 1 day to 12 years old. These patients admitted to Pediatric Hospital of Kirkuk. The control group who were matched to the patients studied, included 60 apparently healthy children and their ages were between 1 day to 12 years old.

The study showed that the highest rate of *Candida* spp. was found in children with diarrhea comparing with the control (93.33% vs. 11.6%) with highly significant relation. In view of mixed infection of *Candida* spp., Table 2 shows that the highest rate of *Candida* spp. was *C. albicans* (26.57%) followed by 21.43% as *C. tropicalis* and the lowest rate was *C. kafyr* (6.25%) while the mixed infection by the four types recorded 30.36%. The highest rate of mixed *Candida* spp. infection with found in children who were infected with *C. albicans* with *C. tropicalis* (23.53%), followed by 17.65% with *C. albicans* and *C. kyrosi* (Table 3). Table 4 shows that the highest rates of *Candida* spp. found in patients who belonged to the age group 1-< 6 years (49.11%) while the lowest rates of *Candida* spp. infections occurred in age group 6-12 years. *Candida* spp. infection occurred more frequently in patients from rural areas than those from urban areas. It was concluded that *Candida* spp. was a highly related with diarrhea in children and *Candida albicans* was the most isolated species.

Keywords: *Candida*, Diarrhea, Children, Kirkuk.

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الكشف عن فطريات المبيضات في الأطفال المصابين بالإسهال في مدينة كركوك

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الملخص

تهدف الدراسة الى بيان العلاقة بين الإصابة بداء المبيضات والاسهال في الأطفال. أجريت الدراسة في مدينة كركوك للفترة من 15 كانون الأول 2017 ولغاية 15 حزيران 2017 وشملت 120 طفل مصاب بالاسهال و60 طفل غير مصاب (كمجموعة سيطرة للدراسة) حيث تراوحت أعمارهم من يوم واحد ولغاية 12 سنة وتم الكشف في نماذج برازهم عن فطر المبيضات.

أظهرت الدراسة ان خميرة المبيضات أصاب 93.33% من الأطفال المصابين بالإسهال مقارنة ب 11.6% في مجموعة السيطرة، ان هنالك علاقة إحصائية معنوية عالية بين المجموعتين وأن اعلى مستوى من الإصابة الخميرية كانت للنوع المبيضات البيض بنسبة 26.57% يتبعها نوع المبيضات الاستوائية بنسبة 21.43% بينما كانت اقل نسبة من الإصابة الخميرية من نوع *C. kafyr* بنسبة 6.25% وأن الإصابات المختلطة بأنواع المبيضات كانت بنسبة 30.36%. بينت الدراسة ان اعلى نسبة من الإصابة بخميرة المبيضات كانت في الذين هم أعمارهم من سنة الى اقل من 6 سنوات (49.11%) بينما اقل نسبة من الإصابة كانت في الأطفال الذين هم أعمارهم بين 6 الى 12 سنة. وأن أعلى نسب الإصابة في المرضى الذين هم من المناطق القروية. يستنتج من الدراسة ان داء المبيضات له علاقة قوية مع الاسهال في الأطفال، وان نوع المبيضات البيض هو النوع السائد.

الكلمات الدالة: داء المبيضات، الاسهال، الأطفال، كركوك.

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1. Introduction:

Diarrheal diseases are a major cause of childhood morbidity and mortality in the worldwide especially in developing world including Iraq. It contributes to the deaths of 4.6 - 6 million children annually in Asia, Africa, and America; and 80% of these deaths occur in the first 2 years of life [1,2]. Despite the availability of effective therapy, diarrhea still kills millions of children each year. In up to 40% of children with presumed infectious diarrhoea, no recognized pathogen can be identified [3,4]. This may be due to the failure to appreciate the significance of certain intestinal microorganisms, such as yeasts. *Candida* species form a ubiquitous genus of yeast present throughout the environment. They are part of the normal flora in the alimentary tract and on mucocutaneous membranes [5,6]. *Candida albicans* is the most common yeast species isolated from human faces, being identified in 65% of stool samples from healthy adults. Nevertheless, several reports have suggested that it may cause diarrhea. These studies have identified candida, but not other enteric pathogens, in the stools of patients with diarrhea and have reported symptom resolution following treatment [7]. *Candida* has been identified in high concentrations in the stools of malnourished children, frequently with associated diarrhea, and it has been reported as the sole “pathogen” in the stools of children with diarrhea [8]. The study aims at evaluating the relation of *Candida* spp. with diarrhea in children.

2. Material and Methods:

A cross sectional study was carried out in Kirkuk city from 15th of January 2017 to 15th of June 2017. The number of patients under study were 120 children between 1 day to 12 years old. These patients admitted to Pediatric Hospital of Kirkuk. The control group who were matched to the patients studied, included 60 apparently healthy children and their ages were between 1 day to 12 years old.

2.1 Methods:

Stool samples were collected using a sterile wide mouth screw cap containers, fresh samples were examined under light microscopy (Olympus CX31RBSF-Philippines) using the high power magnification 40X. Small amount (0.5 ml - 3 ml) of stool specimens were collected in sterile screw cap containers. For each sample, general stool examination, fungal stool culture (Sabourauds dextrose agar and CHROMagar *Candida*).

2.2 Statistical Analysis:

Computerized statistically analysis was performed using Anova version 11 statistic program. Comparison was carried out using; Chi-square (X^2).

3. Results:

A total of 120 children with diarrhea and 60 healthy children (control group), their age ranged between 1 day to 12 years old, were investigated for *Candida* spp. As shown in Table 1, the highest rate of *Candida* spp. was found in children with diarrhea comparing with the control (93.33% vs. 11.6%) with highly significant relation. In view of mixed infection of *Candida* spp., Table 2 shows that the highest rate of *Candida* spp. was *C. albicans* (26.57%) followed by 21.43% as *C. tropicalis* and the lowest rate was *C. kafyr* (6.25%) while the mixed infection by the four types recorded 30.36%. The highest rate of mixed *Candida* spp. infection with found in children who were infected with *C. albicans* with *C. tropicalis* (23.53%), followed by 17.65% with *C. albicans* and *C. kyrosi* Table 3. Table 4 shows that the highest rates of *Candida* spp. found in patients who belonged to the age group 1-< 6 years (49.11%) while the lowest rates of *Candida* spp. infections occurred in age group 6-12 years. In Table 5, *Candida* spp. infection occurred more frequently in patients from rural areas than thoses from urban areas

Table 1: Frequency of *Candida* spp. in stool culture of diarrheal children and the control group.

| <i>Candida</i> spp. | Diarrheal Children | | Control | |
|---|--------------------|-------|---------|------|
| | No. | % | No. | % |
| Positive | 112 | 93.33 | 7 | 11.6 |
| Negative | 8 | 6.67 | 53 | 88.4 |
| Total | 120 | 100 | 60 | 100 |
| $X^2 = 119.074$ $P = 0.00001$ $P < 0.01$ Highly Significant(HS) | | | | |

Table 2: Frequency of *Candida* spp. and their mixed infection in diarrheal children.

| <i>Candida</i> spp. | Patients (No:112) | |
|---------------------------|-------------------|-------|
| | No. | % |
| <i>C. albicans</i> | 32 | 26.57 |
| <i>C. tropicalis</i> | 24 | 21.43 |
| <i>C. kyrosi</i> | 15 | 13.39 |
| <i>C. kafyr</i> | 7 | 6.25 |
| Mixed <i>Candida</i> spp. | 34 | 30.36 |

Table 3: Frequency of *Candida* spp. and their mixed infection in diarrheal children

| | Coinfection (No:34) | |
|---|---------------------|-------|
| | No. | % |
| <i>C.albicans</i> + <i>C. tropicalis</i> | 8 | 23.53 |
| <i>C. albicans</i> + <i>C. kyrosi</i> | 6 | 17.65 |
| <i>C. albicans</i> + <i>C. kafyr</i> | 4 | 11.76 |
| <i>C. tropicalis</i> + <i>C. kyrosi</i> | 5 | 14.71 |
| <i>C. tropicalis</i> + <i>C. kafyr</i> | 4 | 11.76 |
| <i>C. tropicalis</i> + <i>C. kafyr</i> | 1 | 2.94 |
| <i>C.albicans</i> + <i>C. tropicalis</i> + <i>C. kyrosi</i> | 3 | 8.83 |
| <i>C.albicans</i> + <i>C. tropicalis</i> + <i>C. kafyr</i> | 2 | 5.88 |
| <i>C. tropicalis</i> + <i>C. kyrosi</i> + <i>C. kafyr</i> | 1 | 2.94 |

Table 4: Distribution of *Candida* spp. infections according to age.

| Age groups | <i>Candida</i> spp. | |
|------------|---------------------|-------|
| | No. | % |
| < 1 years | 48 | 42.85 |
| 1-<6 year | 55 | 49.11 |
| 6-12 year | 9 | 8.04 |
| Total | 112 | 100 |

Table 5: Residence Distribution of *Candida* spp. infection.

| Residence | <i>Candida</i> spp. | |
|-----------|---------------------|-------|
| | No. | % |
| Rural | 78 | 69.64 |
| Urban | 34 | 30.36 |
| Total | 112 | 100 |

4. Discussion:

Candida albicans is the most common yeast species isolated from human faeces, it has been identified in high concentrations in the stools of malnourished children, frequently with associated diarrhea, and it has been reported as the sole “pathogen” in the stools of children with diarrhea [9]. As shown in Table 1, the highest rate of *Candida* spp. was found in children with diarrhea comparing with the control (93.33% vs. 11.6%) with highly significant relation. In view of mixed infection of *Candida* spp., Table 2 shows that the highest rate of *Candida* spp. was *C. albicans* (26.57%) followed by 21.43% as *C. tropicalis* and the lowest rate was *C. kafyr* (6.25%) while the mixed infection by the four types recorded 30.36%. The highest rate of mixed *Candida* spp. infection with found in children who were infected with *C. albicans* with *C. tropicalis* (23.53%), followed by 17.65% with *C. albicans* and *C. kyrosi* Table 3. Table 4 shows that the highest rates of *Candida* spp. found in patients who belonged to the age group 1-< 6 years (49.11%) while the lowest rates of *Candida* spp. infections occurred in age group 6-12 years. In Table 5, *Candida* spp. infection occurred more frequently in patients from rural areas than those from urban areas.

Jobst *et al* [10] found that *Candida* spp. was the most frequently isolated genus and *C. albicans* the most isolated species from the gastrointestinal tract and *C. tropicalis* was the second. Amer *et al* [11] found that from total of 32 fecal samples, 93.7% revealed positive cultures and 15.6% revealed mixed infections. The predominant isolates were *C. tropicalis* (50%), *C. albicans* (26.7%), *C. krusei* (20%) and *C. glabrata* (3.3%). Vaishnavi *et al.* [12] reported that *Candida* is the most frequently encountered fungal infection of the gastrointestinal tract after antibiotic exposure. Studies have identified *Candida* as the sole pathogen in the stool samples of patients with diarrhea and also reported symptom recovery following treatment [13-

14]. *Candida* spp. has been identified in high concentrations in the stools of malnourished children, frequently with associated diarrhea [15]. Also, it has been suggested as a cause of antibiotic associated diarrhoea in infants [2]. Uppal *et al* [16] found that 56.3% *Candida* isolates were obtained as single isolates and 43.7% *Candida* isolates were obtained as mixture. *Candida krusei* was the more commonly isolated one (52%), followed by *C. tropicalis* (16%), *C. albicans* (0.02%), and *C. parapsilosis* (0.01%). A mixture of *C. albicans* and *C. tropicalis* (12%) and *C. krusei* and *C. tropicalis* (16%) were also isolated. Enweani *et al* [17] in their study conducted in Bangladesh on fungal diarrhea found *C. albicans* to be the most common species (59.4%), followed by *C. tropicalis* (30.9%), *Candida pseudotropicalis* (5.0%) from diarrheal cases. Krause *et al* [18] in their study conducted in Germany found that patients with antibiotic associated diarrhea, *C. albicans* was the most frequent isolate (55%), followed by *C. glabrata* (26%), *C. tropicalis* (5%), *C. krusei* (3%), and other *Candida* spp. (25%). However, a recent study was conducted by Banerjee *et al* [19] revealed that the most common *Candida* spp. obtained from chronic diarrhea cases was *C. tropicalis* (43.8%), followed by *C. albicans* (15.6%), *C. krusei* (15.6%) and *Candida famata* (6.3%). Most patients in the current study were under antibiotic therapy with one or more antibiotics, including cephalosporins, aminoglycosides, and macrolides. Payne *et al* [20] showed that normal gut flora can exert 'natural' resistance to *C. albicans*, but this resistance is lost with antibiotic intake. Helstrom *et al* [21] revealed that the endogenous intestinal flora is reduced with antibiotic intake, and thus leads to uninhibited multiplication of the *Candida* spp. and suggested that antibiotic intake may also damage the anatomical integrity of the intestinal mucosa and modify the intestinal immune response, making it more vulnerable for infection by *Candida* spp. Chaudhury *et al* [22] found that most of 26 clinical strains used in researches were isolated from the faeces (61%), *C. albicans* was predominated. Bishop *et al* [23] identified *C. albicans* in the stools of one third of children with acute gastroenteritis who their age less than 1 year. Other studies reported high rate of *C. albicans* infection among infants aged ≤ 12 months [17,22]. Extremes of age and administration of antibiotics and steroids may act as predisposing factors for *Candida* diarrhea [24]. This is in accordance with the findings in the present study. The significant higher seroprevalence of *Candida* in rural patients compared to urbans related to poor personal hygiene, absence of sewage disposal, unsafe water supply and presence of extended families [25].

5. Conclusions:

It was concluded that *Candida* spp. was a highly related with diarrhea in children and *Candida albicans* was the most isolated species.

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