

## Significance of Fungal Species Isolated from Blue Nile River and Tuti Island on Drinking Water Quality

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### Authors' contributions

This work was carried out in collaboration between all authors. Author SEAB designed the study, wrote the protocol and wrote the first draft of the manuscript. Author WYA managed the literature searches and analyses of the study performed. Authors SEAB, WYA and WMM managed the experimental process. All authors read and approved the final manuscript.

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### ABSTRACT

**Aims:** This study has been carried out with the following objectives: Assessment of contamination of water in Blue Nile through fungi of different water samples collected and Identify, as far as possible, the species responsible for contamination and, to a diver these problems.

**Study Design:** The study was designated as cross sectional experimental study.

**Place and Duration of Study:** This study was conducted at the Department of Microbiology and Molecular Biology, Faculty of Science and Technology, Al-Neelain University, Khartoum – Sudan “1<sup>st</sup> March to 30<sup>th</sup> June 2012”.

**Methodology:** Ten samples were collected from each untreated water source (Blue Nile River) and treated water source (Tap water from Tuti Island). All samples were divided into two groups; group one, the samples were inoculated in (Potato dextrose agar containing Chloramphenicol and Rose Bengal) while group two the samples were inoculated in (Potato dextrose agar containing Chloramphenicol).

**Results:** Four genera of aquatic fungi were isolated from Blue Nile water that has been inoculated in PDA, Chloramphenicol and Rose Bengal; these were *Fusarium* spp., *Aspergillus fumigatus*, *Candida albicans* and *Aspergillus niger* in frequency percentage of 41.47%, 25%, 25%, and 8.33%

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respectively. While the isolated genera from Blue Nile water that inoculated in PDA + Chloramphenicol were three as *Fusarium* spp., *Aspergillus niger* and *Candida albicans* with percentage of 70%, 20%, and 10% respectively. Also three genera were isolated from tap water that inoculated in PDA + Chloramphenicol and Rose Bengal as *Mucor* spp., *Aspergillus fumigatus*, and *Rhizopus* spp. and the frequencies are (72.73%, 18.2%, and 9.1%) respectively. The isolated genera from tap water which inoculated in PDA + Chloramphenicol show *Mucor* spp. (57.14%), *Rhizopus* spp., *Aspergillus fumigatus* and *Aspergillus terreus* with frequency of 14.29% for all three lateral genera. Most genera were shown sensitive when subjected to the different concentrations of chlorine (0.2, 0.5, and 0.7 g/ 50 ml) except *Candida albicans*, *Fusarium* species, and *Aspergillus niger* were shown resist to chlorine concentration 0.5 g/ 50 ml.

**Conclusion:** The recovers of fungi from drinking water indicates low levels of quality and need intensive treatment.

**Keywords:** *Fusarium*; water purification; *Candida albicans*; fungi; *Aspergillus*; *Rhizopus*.

## 1. INTRODUCTION

The Nile River is the main drinking water resource for the Sudanese people providing %97 of their water. The problem of water quality is especially acute for developing world where up to %90 of cities discharge their untreated sewages into rivers and streams. The problem of air pollution is continuing to grow more acute in the developing world population are expanding rapidly and rapid industrialization is complied with increasing use of motor vehicles the air condition and fresh water quality in the area around the Nile river have been severely affected. The impact of pollution in Sudan appears in all environments [1]. The contaminants that are found in drinking water are bacteria, viruses, pathogenic protozoa, algae and fungi (yeast and mould) are important causes of water borne diseases [2]. Fungi in water are becoming more important because of increasing number of immune -suppressed patients, nonetheless water borne fungi are associated with taste and odour problem. Study of water borne fungi are low because primary fungi histoplasma, coccidiodes, blastomycete, paracoccidiodes are not known as water borne. However there is a number of opportunistic human fungi pathogen which are known to be water borne and several studies have suggest that inhalation water isolated aerosols containing Spores of these fungi may be route in systematic infection in human [3]. Furthermore some fungal species from water supplies are potentially allergenic or toxigenic [4]. This study has been carried out with the following objectives: Assessment of contamination of water in Blue Nile through fungi of different water samples collected and Identify, as far as possible, the species responsible for contamination and, to a diver these problems.

## 2. MATERIALS AND METHODS

### 2.1 Collection of Sample from Blue Nile River

The water sample were collected from Blue Nile as follow: 180 ml of water sample were collected in sterile clear glass container put at the angle 45° and opened under water for distance 20 cm, filled and small spaces were lift for shaking and screwed, then the bottles were transported to the laboratory using ice-bag within two hours [5].

### 2.2 Collection of Water Sample from Tap Water

The water sample were collected from taps as follow: 180 ml of water sample were collected in sterile clear glass bottle contained sodium thiosulphate to remove residual chlorine, the tap was cleaned by tissue and alcohol to remove the dust and sterilize by flaming, the water was flowed for one minutes before sampling without touch or contaminate cap, the sample bottle was carefully opened and filled, a small spaces were lift for shaking and screwed, the sample was transported to the laboratory using ice-bag within two hours [5].

### 2.3 Isolation of Fungi from Water Sources

Ten water samples from Blue Nile River and a ten water sample from tap were collected. The samples were inoculated onto sterilized potato dextrose agar in two batches, batch one supplemented with rose Bengal and chloramphenicol while batch two supplemented with chloramphenicol only. By taken 0.1 ml of water sample and inoculated onto the surface of sterilize plates, then the plates were incubated at 28°C for 5 days [6].

### 2.4 Effect of the Chlorine in Fungal Growth

To study the effect of chlorine in fungal growth, the twenty samples were treated with 0.2, 0.5, 0.7 g chlorine respectively. These concentrations were added to 50 ml of water sample and let for 1 hour.

## 3. RESULTS AND DISCUSSION

### 3.1 Area of Study

This study was conducted at the Department of Microbiology and Molecular Biology, Faculty of Science and Technology, Al-Neelain University, Khartoum – Sudan. All the experiments were accomplished aseptically in the Laboratory of Microbiology.

### 3.2 Isolated Fungi Inoculated in PDA + Chloramphenicol + Rose Bengal (Blue Nile River)

The dominant genera isolated from Blue Nile River are the *Fusarium* species which shown in 5 sample out of twelve (41.47%) followed by *Aspergillus fumigatus* and *Candida albicans* which isolated from 3 sample (25%), finally, *Aspergillus niger* shown in one sample (8.33%) Fig. 1.

### 3.3 Isolated Fungi Inoculated in PDA + Chloramphenicol (Blue Nile River)

*Fusarium* species were also shown in 7 outgrow of ten sample collected (70%), followed by *Aspergillus niger* which was isolated from 2 sample (20%) and *Candida albicans* which observed in one sample (10%) *Aspergillus fumigatus* did not shown in this medium Fig. 2.

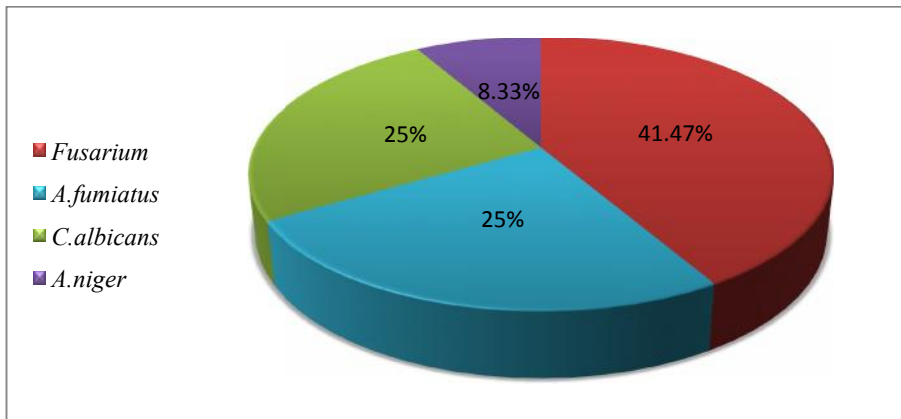


Fig. 1. The percentage of isolated fungi from Blue Nile River inoculated onto PDA supplemented with rose Bengal and Chloramphenicol

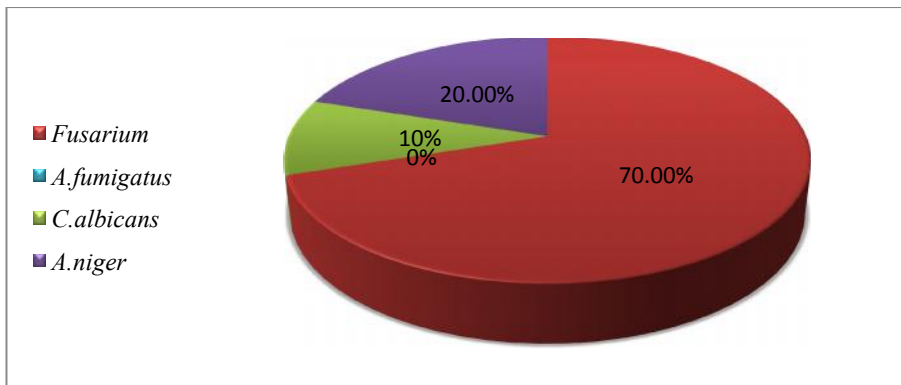


Fig. 2. The percentage of isolated fungi from Blue Nile River inoculated onto PDA supplemented with Chloramphenicol

### 3.4 Isolated Fungi Inoculated in PDA+ Chloramphenicol +Rose Bengal (Tap Water)

The dominant mould isolated from tap water are the *Mucor* species which was shown in 8 samples (72.73%) followed by *Aspergillus fumigatus* which was shown in two samples (18.2%) and *Rhizopus stolonifera* shown in one sample (9.1%) Fig. 3.

### 3.5 Isolated Fungi Inoculated in PDA+ Chloramphenicol Only (Tap Water)

*Mucor* species also appeared as the predominant mould that isolated from four samples (57.14%), followed by *Rhizopus stolonifera*, *Aspergillus fumigatus*, and *Aspergillus terreus* which were shown on one sample (14.29%) Fig. 4.

The outcome of this study is similar to the Warris et al. [7], who reported that the dominant fungi

isolated from water are *Fusarium* and *Aspergillus* species, and it is resemble to that of Denning et al. [8], and Straus, [9], whom reported that the water are contaminated by microorganisms such as *Aspergillus fumigatus*, *Mucor*, *Abisidia*, and *Candida albicans*.

The percentage of these fungi isolated it is semi-like to Rukaia et al. [10] who reported that the percentage of finding fungi as the follow *A. niger* 27% this is more than the outcome of our study (20%), *A. fumigatus* 24.1% which is almost similar of our finding, *Fusarium spp.* 41.47% this is more than the outcome of our study (25%), *Rhizopus spp.* 14.29% shown less than isolated species in this study (20.4%), and *Mucor spp.* are not isolated during the investigation of Rukaia et al. [10] who reported that the percentage of *Mucor spp.* is zero percent (0.00%) which is in contradiction with our finding as dominant fungi that isolated from the tap water (72.73%).

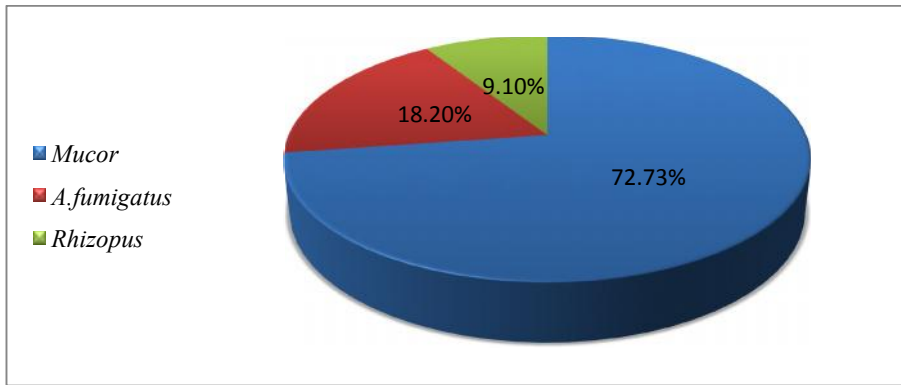


Fig. 3. The percentage of isolated fungi from tap water inoculated onto PDA supplemented with rose Bengal and Chloramphenicol

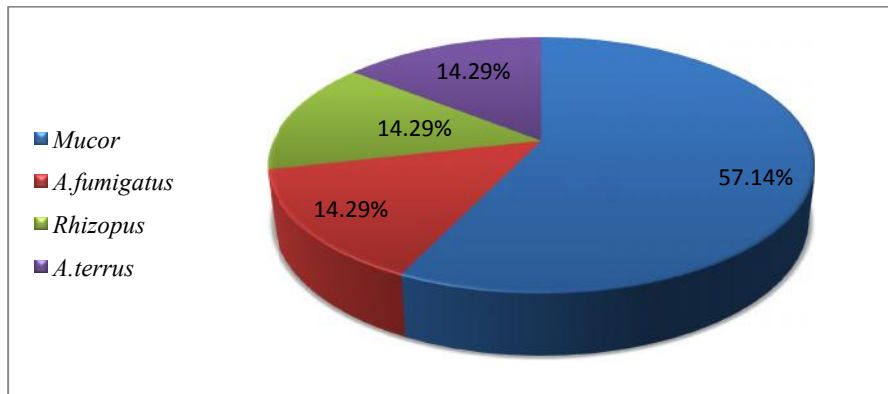


Fig. 4. The percentage of isolated fungi from tap water inoculated onto PDA supplemented with Chloramphenicol

**Table 1. Effect of chlorine concentration on the growth of fungal isolation**

No of sample	Resistant fungi	Concentration of chlorine (gram /50 ml)		
		0.2 g	0.5 g	0.7 g
1	<i>Candida albicans</i> , <i>Fusarium</i> species, <i>Aspergillus niger</i>	Growth	Growth	No growth
2	<i>Candida albicans</i> , <i>Fusarium</i> species, <i>Aspergillus niger</i>	No growth	Growth	No growth
3	<i>Candida albicans</i> , <i>Fusarium</i> species, <i>Aspergillus niger</i>	No growth	Growth	No growth
4	<i>Candida albicans</i> , <i>Fusarium</i> species, <i>Aspergillus niger</i>	No growth	Growth	No growth
5	Not found	No growth	No growth	No growth
6	Not found	No growth	No growth	No growth
7	Not found	No growth	No growth	No growth
8	Not found	No growth	No growth	No growth
9	Not found	No growth	No growth	No growth
10	Not found	No growth	No growth	No growth

### 3.6 Effect of the Chlorine in Fungal Growth

All samples that treated with chlorine 0.7 g/ 50 ml were shown no growth that means it inhibited with the presence of this dose in the water treatment, also all samples that treated with 0.2 g/ 50 ml shown no fungal growth except sample one. At 0.5 g/ 50 ml chlorine was shown effect against almost half of the samples (6 out of 10).

Four samples out of ten contain (*Candida albicans*, *Fusarium* species, and *Aspergillus niger*) were shown resist to chlorine concentration 0.5 g/ 50 ml, while the rest were shown sensitive (Table 1 above). These findings are in line with Bushra and Fayadh, [11] who stated that despite relatively higher concentration of free chlorine, fungi survived chlorine treatment in descending order were *Aspergillus* spp., *Penicillium* spp. and *Cladosporium* spp. which were recovered with higher frequency, *Alternaria* spp., *Rhizopus stolonifer*, *Chaetomium* sp. and *Fusarium* sp. with very low frequency.

The treatment of water in this study shown the concentration of 0.2 g is similar to Davis and Lambert, [12] and 0.7 g (not study yet) were effective in elimination of microorganism and the concentration of 0.5 not effect in treatment water not similar to Action Contre La Faim [13], who reported that the concentration 0.5 g effect in water treatment. This study is in line with Gunhild et al. [14] and Okpako et al. [15] who revealed that fungi are relatively common in water distribution systems and most fungal species survive disinfection.

### 4. CONCLUSION

We concluded, the study of fungi in drinking water has demonstrated that fungi are relatively common in water distribution systems species of pathogenic, allergenic, and toxigenic concern are isolated from water, sometimes in high concentrations fungi in water may be aerosolized into air, and introduced to immunocompromised patients, and sensoric changes have been associated with the occurrence of fungi in drinking water system. The recovers of fungi from drinking water indicates low levels of quality.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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