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Mucormycosis related knowledge among a sample of the general population in Egypt

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ABSTRACT

In the fight against COVID-19, the mass usage of broad-spectrum antibiotics and steroids may result in the development or worsening of a pre-existing fungal disease. The researchers conducted the current study among a sample of the general population in Egypt to assess their mucormycosis-related knowledge. The current work was an exploratory cross-sectional study performed via an online survey. The investigators conducted a convenience sampling by looking for large-networked groups on Facebook; 473 completed the questionnaire. It included: socio-demographics, 28 knowledge questions addressing definition, risk factors, modes of transmission, symptoms, and prevention of mucormycosis, and sources of knowledge. The median total knowledge percent score was 58 (9-38). The least median percent score was 25 (0-83) for prevention knowledge. The comparison between knowledge percent score and participants' demographics showed no statistically significant difference. However, the participants working in the medical field had a higher median knowledge percent score, with a p-value <0.05. The major sources of information were cited as being the internet and social media. Despite being educated, and most of the enrolled individuals were university graduates, most participants had insufficient mucormycotic knowledge. This emphasizes the importance of conducting mucormycosis awareness campaigns for the public.

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1. INTRODUCTION

COVID-19 remains a major concern all over the world. Unfortunately, COVID-19 is associated to an increased level of secondary infections, both fungal and bacterial, commonly because of immune disturbance [1], [2]. The widespread usage of broad-spectrum antibiotics and steroids in the fight against COVID-19, as well as public misuse, can lead to the development or worsening of a pre-existing fungal infection [3]. Mucormycosis is a life-threatening, opportunistic, angioinvasive fungal infection [4]. Particularly those who were hospitalized to the intensive care unit (ICU) and required mechanical ventilation or who had longer hospital stays, severely unwell patients are more prone to get fungal co-infections [5], [6]. Cases with uncontrolled diabetic mellitus and those who unintentionally get steroid medication continue to be at risk for contracting COVID-19 and the accompanying mucormycosis (CAM) [7]. It has yet to be shown whether

increased vaccination rates and early detection because of increased knowledge would lead to a decrease in CAM rates and negative consequences. A national register would make it possible to track disease patterns more effectively [8].

Therefore, it is essential to note that COVID-19 cases are susceptible to further fungal infection during this disease's middle and latter stages, especially severely ill ones [9]. Despite the fact that the majority of CAM patients have been recorded from India [10], [11], other nations, including Egypt [12], Iran [13], and Chile [14], have noted increases in the incidence of mucormycosis infection during the COVID-19 pandemic. If mucormycosis is detected early enough, it can be treated with systemic antifungal chemotherapy based on amphotericin B and radical debridement or excision of devitalized tissue, as well as the underlying immunosuppressive disorder or disease. Consequently, raising concern about opportunistic infections will help to minimize morbidity and mortality [15], [16].

The general public's understanding of mucormycosis is critical for conceptualizing, developing, and executing a health education intervention to increase knowledge and ensure that the health education goal is accomplished. There hasn't been any prior research to date evaluating Egyptians' general understanding of mucormycosis. This will play a valued role in disseminating reliable information about mucormycosis, symptoms, risk factors, and prevention. In order to determine the general Egyptian population's understanding of mucormycosis, the researchers performed the present study using an open online survey. The research question is in a sample of the general population in Egypt, what are mucurmycosis knowledge and associated factors? this research is aimed to assess their mucormycosis-related knowledge among a sample of the general population in Egypt and associated demographic characteristics.

2. RESEARCH METHOD

The present research is an exploratory cross-sectional study conducted among a broad population sample between May 1 and June 2 of 2021, coinciding with an upsurge in mucormycosis in Egypt, to gauge their understanding of mucormycotics. The checklist for reporting results of internet e surveys (CHERRIES) standards were used for conducting the study [17]. The researchers employed a practical sampling strategy. We established the most appropriate assumption (p) for the current study, 50%, as there hasn't been any previous research of its kind that specifically examined knowledge of mucormycosis. Formula used to determine sample size: n (needed sample size) =50%, E (margin of error) =1.96, P (prevalence of result) =0.05. A sample of 377 people was needed if the non-response rate were 20%. Over this time, 473 persons answered the questionnaire in total. Participants must be willing to participate, adults above the age of 18, and Egyptians.

The information from participants was gathered using a pre-tested 2-page (screen) e-questionnaire. It was divided into three parts:

i) Socio-demographic features (e.g., age in years, sex, occupation (medical or not), education, marital status, and governorate)

ii) The participants knowledge about Mucormycosis had an overall 28 objects, including items addressing definition, risk factors, and modes of transmission (14 questions), symptoms (8 questions), and prevention (6 questions). The questions had three possible answers: yes, no, and do not know.

iii) Multiple formats of information sources concerning mucormycosis, such as academic websites, medical research, colleagues and/or healthcare professionals, the Internet, WhatsApp, Facebook, television, and others.

The questions in these sections were adapted from a previous study [18]. The questions were then translated into Arabic by two separate language specialists, who then had two more translators translate the questions back into English.

Because of the social distance required by the COVID-19 critical circumstances, the researchers chose to gather their data online. The applicants have to finish and send a Google Form. The most popular social media networks in Egypt are Facebook and WhatsApp, thus the researchers distributed the survey link to those groups. The administrators of these groups were contacted to request approval to disseminate this survey. The URL to the survey was then provided, along with a motivating explanation of its goal and one of the researchers' contact details. The researchers avoided duplicate entries by preventing users from accessing the survey twice.

To evaluate the questions' clarity, a pilot test was carried out with 10 individuals (who were not involved in the study's findings). Adjustments were made where needed. The content of the questionnaire was evaluated by four faculty members who are specialists in public health, and the necessary adjustments were made. Via a back button, the responders may evaluate and modify their responses. A Cronbach's alpha test of reliability was performed for the whole questionnaire. Result was =0.72.

Completion rates is ratio of people that accepted to participate/completed the survey. The completion and participation rates were calculated as =473/473=100%.

For statistical analysis, the researchers employed IBM's SPSS version 24.0 (Statistical Package for Social Science, USA). A normality check was done on the variables. Proportions and percentages were used to express categorical variables. In order to compare quantitative variables, the researchers employed the Mann-Whitney U and Kruskal-Wallis tests of significance. Quantitative data were reported using mean, standard deviation, median, and interquartile range (IQR). p-values of 0.05 or below were regarded as significant. Answers that demonstrate true knowledge have been given a score of one, whereas false or "I don't know" responses have been given a score of zero. If all answers were correct, the total raw score was 28. By dividing the raw score by 28 (the highest possible score), which is the percent score, and multiplying the result by 100, the percent score was determined. Ethics approval and consent to participate: The Ministry of Health and Population Research Ethics Committee granted permission for the study under the number.14-2021/15. After being made aware of the objective of the study and the significance of the online form prior to data collection, the study participants electronically signed a permission form indicating their written informed consent.

3. RESULTS AND DISCUSSION

The questionnaire was distributed to 490 participants; 473 (96.5%) of them agreed to complete it, while 17 (3.5%) refused to complete the survey. The mean age of the participants was 31±8 years. The age was grouped into 10-year intervals; 55% of the participants were between 25 to 34 years old, followed by those aged 35 to 44 (23.7%). More than three-quarters of the participants (77.6%) were females, more than half of the study participants (55.8%) were married, and about fifty-six percent were university graduates. Two-thirds of the study participants (67%) were working, with 64.4% employed in medical professions (Table 1). Out of the 473 participants who completed the questionnaire, 444 (93.9%) of them had heard before about black fungus (mucormycosis). Tables 2 and 3 show the detailed right answers to the 28 questions.

Table 1. Baseline characteristics of the enrolled study participants

Characteristics	(n=473)
Age (n, %)	
≤24 years	73 (15.4)
25-34 years	260 (55)
35-44 years	112 (23.7)
≥45 years	28 (5.9)
Sex (n, %)	
Male	106 (22.4)
Female	367 (77.6)
Education (n, %)	
Primary and secondary education	15 (3.2)
University student	67 (14.2)
University graduate	264 (55.8)
Postgraduate	127 (26.8)
Working status (n, %)	
Working	317(67.0)
Not working	156 (33.0)
Marital status (n, %)	
Married	264 (55.8)
Not married	209 (44.2)
Occupation (n, %) total=315	
Medical	203 (64.4)
Non-medical	112 (35.6)
Residence (n, %)	
Urban	419 (88.6)
Rural	54 (11.4)
Governorate (n, %)	
Greater Cairo	383 (81)
Suez Canal governorates	7 (1.5)
Lower Egypt governorates	59 (12.5)
Upper Egypt governorates	24 (5.0)

The main source of knowledge was the internet, followed by social media (38.4%, 28.7%, respectively), as shown in Figure 1. The least median percent score was for the prevention knowledge 25 (0-83), followed by the knowledge about the symptoms 50 (25-75), general knowledge (related to the nature and mode of transmission of the disease) 50 (43, 64), and the median total knowledge percent score 58 (38-79), as shown in Table 4.

Table 2. Mucormycosis-related knowledge (general knowledge and mode of transmission) among the enrolled participants who heard about Mucormycosis (n=444)

Characteristics	n (%)
General knowledge	
It is a fungal disease	367 (82.7)
It is a new disease (not identified before)	314 (70.8) *
It is a common disease	297 (66.9) *
It is present in Egypt	351 (79.1)
It is a serious disease (the death rate from it is high)	269 (60.6)
It has treatment	204 (45.9)
Disease patients can be controlled	200 (45.0)
Mode of transmission	
It can be transmitted from person to person	78 (17.6)
Can be transmitted through inhalation	132 (29.7)
It can be transmitted through contaminated food	162 (36.5)
Can be transmitted through contacting contaminated surfaces	131 (29.5)
Can be affected healthy people with potent immunity	297 (66.9) *
There are more people at risk for getting the disease than others	385 (86.7)
It can affect the COVID-19 patients	387 (87.2)

*"no" response is the correct response in these questions

Table 3. Mucormycosis related knowledge (disease symptoms and prevention) among the enrolled participants who heard about Mucormycosis (n=444)

Characteristics	n (%)
Symptoms (n=444)	
Black skin vesicles and ulcers	198 (44.6)
Black nasal inflammatory secretions	259 (58.3)
Black inflammation in the mouth	214 (48.2)
Black inflammation in the eye	268 (60.4)
Facial inflammation and edema	269 (60.5)
Severe painful cough	110 (24.8)
Blood clots	112 (25.2)
Tissue death and gangrene	240 (54.1)
Prevention (n=240)	
It is a preventable disease	240/444 (54.0)
General and personal hygiene	222/240 (92.5)
Sterilization of medical equipment	212/240 (88.3)
Eating fresh food	184/240 (76.7)
Avoid overuse of drugs such as antibiotics and corticosteroids	224/240 (93.3)
Taking COVID 19 vaccine	160/240 (66.6)

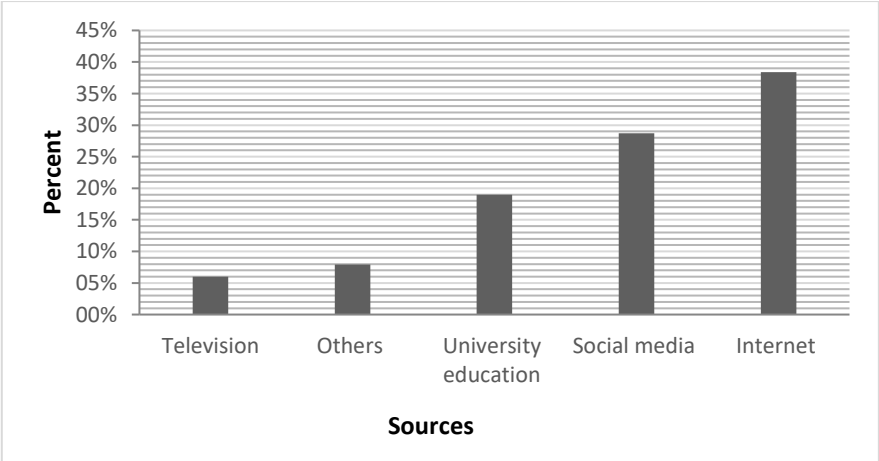

Figure 1. Percent distribution of the study participants by Mucurmycosid source of knowledge

Table 4. Median Mucormycosis knowledge scores among the enrolled participants

Score	Median (IQR)
General knowledge score	7 (6-9)
Symptoms knowledge	4 (2-6)
Prevention knowledge	2 (0-5)
Knowledge score	14 (9-19)
General knowledge percent score	50 (43-64)
Symptoms knowledge percent score	50 (25-75)
Prevention knowledge percent score	25 (0-83)
Knowledge percent score	58 (38-79)

When the knowledge percent score was compared to age, gender, marital status, governorate, and working status, no statistical significance in general knowledge, symptoms, prevention, and total knowledge percent score was found. The comparison between educational levels and knowledge score demonstrated a significant increase in postgraduates regarding total knowledge percent score median 65 (42, 83), with a p-value of 0.04. There was a substantial rise in general symptoms, prevention, and total knowledge percent scores for those working in medical professions (p-value <0.001), as displayed in Table 5. According to Figure 2, participants with a university education had a higher median total percent score (p-value 0.001).

Table 5. Association between socio-demographic characteristics of the enrolled participants and Mucormycosis knowledge percent score

Variable	Knowledge percent score			
	General and mode of transmission	Symptoms	Prevention	Total
Age group *Median (IQR)*				
≥24	57 (43.64)	50 (25.75)	50 (0.83)	58 (42.75)
25-34	50 (36.64)	50 (25.75)	0 (0.83)	63 (38.79)
35-44	50 (43.64)	38 (25.63)	0 (0.100)	50 (29.79)
≥45	57 (43.64)	50 (25.75)	83 (0.100)	58 (38.79)
p-value	0.35	0.25	0.52	0.33
Sex *Median (IQR)*				
Male	50 (36.64)	50 (25.63)	50 (0.83)	58 (42.79)
Female	50 (43.64)	50 (25.75)	0 (0.100)	58 (38.79)
p-value	0.28	0.21	0.47	0.79
Marital status *Median (IQR)*				
Married	50 (36.64)	50 (25.75)	0 (0.100)	58 (33.79)
Not married	50 (36.64)	50 (25.69)	33 (0.83)	58 (42.75)
p-value	0.8	0.9	0.54	0.95
Governorate *Median (IQR)*				
Greater Cairo	54 (43.64)	50 (25.75)	33 (0.83)	58 (38.79)
Suez Canal governorates	50 (43.64)	19 (0.88)	17 (0.83)	58 (33.63)
Lower Egypt governorates	50 (36.64)	50 (25.75)	0 (0.100)	58 (38.79)
Upper Egypt governorates	50 (36.64)	50 (38.75)	0 (0.100)	58 (33.79)
p-value	0.89	0.73	0.99	0.95
Education *Median (IQR)*				
Primary and secondary education	57 (43.64)	50 (0.50)	0 (0.100)	58 (33.83)
University student	50 (36.64)	38 (25.75)	50 (0.83)	58 (42.75)
University graduate	57 (43.64)	50 (25.63)	0 (0.83)	54 (33.75)
Post graduate	50 (43.64)	50 (25.75)	67 (0.100)	65 (42.83)
p-value	0.1	0.23	0.02*	0.04*
Working status *Median (IQR)*				
Working	50 (36.64)	50 (25.75)	17 (0.83)	58 (38.79)
Not working	57 (50.64)	50 (25.63)	25 (0.83)	58 (38.75)
p-value	0.81	0.1	0.99	0.5
Occupation *Median (IQR)*				
Medical services	57 (50.64)	63 (38.75)	67 (0.100)	67 (50.79)
Non-medical services	43 (29.57)	38 (13.50)	0 (0.83)	42 (25.63)
p-value	<0.001*	<0.001*	<0.001*	<0.001*
Medical occupation *Median (IQR)*				
Physician	57 (50.64)	63 (38.75)	83 (0.100)	71 (54.83)
Pharmacists	57 (43.64)	63 (25.50)	83 (0.100)	63 (50.79)
Others	50(36.57)	50 (25.75)	0 (0.83)	50 (35.69)
p-value	<0.001	0.04*	0.03*	<0.001*

*significant

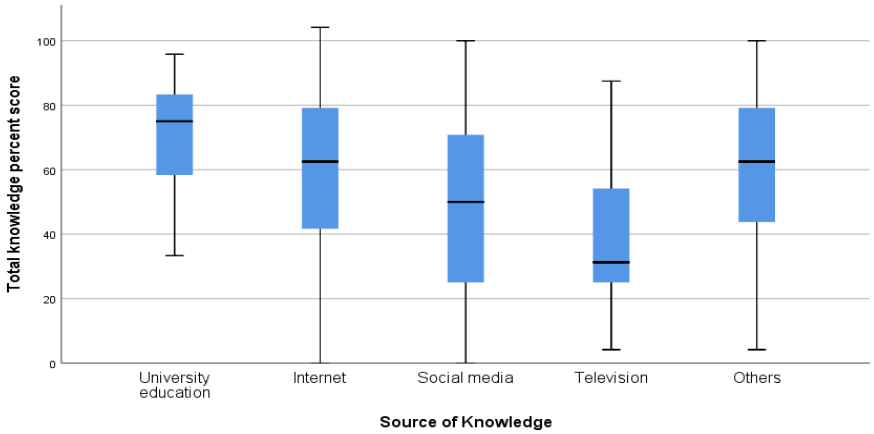

Figure 2. Total knowledge percent score by the source of knowledge

The current study found that there is low knowledge score as the median knowledge percent score of the studied population was 58 (IQR 38-79), which is in same line with research performed in India assessing attitude, knowledge, and practice toward mucormycosis in cases presenting to six tertiary eye care hospitals [19] and also similar to results of study conducted in Bangladesh [20]. Thus, the government should initiate a comprehensive awareness campaign on social media and the mainstream media to increase knowledge and awareness of the general population regarding the mode of transmission, symptoms, and preventive measures of mucormycosis. Knowledge and behavior of the general population in developing countries will determine the rate of spread of infectious diseases as their health facilities are not capable of handling any pandemic disease like COVID-19 and mucormycosis. Proper knowledge about communicable diseases is the key to formulating the behavior of the general population during any pandemic [21].

The relation between socio-demographic characteristics and knowledge about mucormycosis revealed that male and female participants had nearly identical knowledge percent scores with no statistically significant difference. These results are consistent with those of research on Egyptians' perceptions, knowledge, and attitude against COVID-19 [22]. It may be attributed to the fact that Egyptian females have equal access to education and information sources as males without gender discrimination.

We found that study participants with a postgraduate degree were more knowledgeable than graduates, emphasizing the importance of education in improving knowledge scores (p=0.04). The same finding was reported in a study conducted in India [23]. It could be because subjects engaged in academic activities and postgraduate studies are exposed to more learning experiences, leading to continuous knowledge updating. Participants with a medical background were significantly more knowledgeable than other participants in this study. The current results align with other studies in Dutch [24] and India [25].

The current exploratory study revealed that around 67% of the participants responded that the mucormycosis did not affect healthy people with potent immunity. These findings agree with previous ones, indicating that more than half of the public was aware of CAM. The participants reported that CAM was caused in subjects with immunosuppressed immunity [26]. In the current study, 82.7% of study participants knew that mucormycosis is a fungal disease, and more than half of study participants (60.6%) correctly identified it as a fatal illness, and 45.9% identified that there is a treatment for it. The previously mentioned study obtained similar results. More than 85% of the participants identified that mucormycosis is a fungal disease; around three quarters of the participants reported that CAM causes mortalities from 2% to 70%. Approximately 44.8% of survey participants thought amphotericin B was an antibiotic prescribed to treat CAM [26], and these results were similar to another study conducted in the USA [27].

Regarding the knowledge of mucormycosis mode of transmission, in the current study, only 17.6% said that mucormycosis could be transmitted from person to person either by contact or through the air, or food. This was less than the previously mentioned results in the Indian study, as 40% of the respondents said that the route of entry for CAM was through the nasal system. About 34% of respondents stated that the eye was the route of entry for CAM and 16.5% for lungs [19]. In the current study, there was adequate knowledge about symptoms of mucormycosis. In India, it was found that around 55% identified that swollen eyes, the formation of black spots, and infection of the brain are the symptoms of CAM [19].

In the current study, about 66.6% of the participants reported that the COVID-19 vaccine could prevent mucormycosis, which is similar to the study performed in India. About 67.3% of participants were

believed that the COVID-19 vaccination could control the CAM [28]. Preventing mucormycosis could avoid the overuse of drugs such as antibiotics and corticosteroids were reported in more than 90% of the participants in the current study. This was similar to a study in which 64.6% of the participants reported that the inappropriate use of antibiotics could cause more severe illness [29].

Additionally, we identified a significant reliance on the use of the internet and social media as means of accessing mucormycosis-related knowledge by study subjects, compared to other sources such as University education and television. This emphasizes the massive shift to social media use and could also inform stakeholders and information providers on reviewing the importance of customizing distributed information for access via the internet and social media (e.g., via applications). This is persistent with study conducted among community pharmacists in Kosovo [24], [30], and other study in the United States evaluating knowledge regarding the COVID 19 [27].

Although only 19% of the studied population depended on university education as the source of mucormycosis-related information, those participants had a significantly higher knowledge percent score than those dependent on other sources (p=<0.001), which might be attributed to other sources the valid and comprehensive information provided through university. On the other hand, the study participants have lower knowledge percent scores depending on the internet and social media as the main source of knowledge. This may be explained by the discovery made by Dutta and his colleagues, who discovered that the trustworthiness and quality of the material of the majority of YouTube videos regarding severe acute respiratory syndrome 2 (SARS-CoV-2) and COVID-19 were determined to be inadequate [31].

One of the current study's limitations is the collection of online data from internet users during a difficult period when the pandemic in Egypt was spreading quickly and preventive measures such as social distances and partial lookdown were in place. Due to some communities' lower likelihood of having internet access and responding to online questions, online surveys have limited sampling and respondent availability. Furthermore, because there is no interviewer present, there is a lack of clarification and probing in online surveys, which may result in less reliable data. Nonetheless, the study contains useful policy information on all of the important influential aspects of knowledge, behaviour, and preventive measures for mucormycosis control.

4. CONCLUSION

The general public's understanding of mucormycosis is critical for conceptualizing, developing, and executing a health education intervention to increase knowledge and ensure that the health education goal is accomplished. The comparison between the knowledge percent score and participants' demographics showed no statistically significant difference. However, the participants working in the medical field had a higher median knowledge percent score. Despite being educated and most of the enrolled individuals being university graduates, most participants had insufficient mucormycotic knowledge. This emphasises the importance of conducting mucormycosis awareness campaigns for the public.

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