

# Young Doctors' Knowledge, Attitudes, and Practice regarding Naegleria Fowleri in a local tertiary care hospitals of Lahore

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## ABSTRACT

**Aims:** To analyze the response of young MBBS doctors and to assess the knowledge, Attitude and knowledge towards Naegleria fowleri infection in two private hospitals of Lahore.

**Methods:** A close ended questionnaire was distributed to 145 young doctors at Gurkhi Trust Teaching hospital and Combined Military Hospital, Lahore.

**Results:** A cross-sectional study was conducted to assess the knowledge, attitude and practices of young doctors towards Naegleria fowleri and the infection it causes. A questionnaire was distributed to them in two private hospitals. Descriptive statistics were used to demonstrate young doctors' demographic information and their responses to the questionnaire. The study revealed that young doctors were not having adequate awareness of Naegleria fowleri infection, they need to consider it as a serious health issue that necessitates instantaneous steps by the government to prevent the general public from the fatal neurological infection. It is recommended that appropriate methods should be projected in the community from time to time that increases public awareness about the associated risk factors.

**Conclusions:** It is concluded that young MBBS doctors were not having adequate awareness of N. fowleri or the infection it causes and consider it as a serious health issue that necessitates instantaneous steps by the government to prevent the general public from this fatal neurological infection.

**Keywords:** Naegleria fowleri, swimming and infections

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## INTRODUCTION

The worldwide distribution of a group of ameboflagellate belonging to genus Naegleria has been identified. Among several species of this group, only Naegleria fowleri is responsible for causing diseases in humans<sup>1</sup>. In 1965, Naegleria fowleri was first described by Fowler and Carter as human pathogen in Australia<sup>2</sup>. Naegleria fowleri is a free living amoeba found in fresh water reservoirs, hot springs, warm water lakes and unchlorinated water of swimming pools [3]. N.fowleri is thermophilic protist and proliferates in waters having temperature above 30°C. Its life cycle consists of three forms. The first form, amoebic trophozoite form is limax or shoe shaped considering invasive reproductive form measuring 7-20 µm. This form has a clear nucleus and prominent nucleolus so in clinical specimens it is the most commonly isolated form. It thrives best in temperature form 35-46 °C but when there is shortage of food or environmental conditions are unfavorable then trophozoite form becomes a resistant cyst. The second form is motile flagellated pear shaped form in which amoeba is unable to divide and feed. The third form is double walled cyst which is infective form and can be transformed into trophozoite form when it gets a favorable environment<sup>2</sup>.

Naegleria fowleri can cause diseases of central nervous system in humans especially meningoencephalitis. It occurs when the water containing N. fowleri enters into the nasal cavity then this amoeba pierces the cribriform plate and reaches the brain causing granulomatous inflammation which leads to meningoencephalitis known as

primary amoebic meningoencephalitis (PAM)<sup>4</sup>. Symptoms of PAM appear approximately within 5 days after exposure to N.fowleri and cannot be differentiated from bacterial meningitis initially. Early symptoms include nausea, vomiting, fever, headache, progressing to altered mental status and coma. Death can occur within the 5 days after the onset of symptoms<sup>5</sup>.

Histology describes the acute inflammation due to presence of neutrophils and lytic necrosis of a large area having several trophozoites. Absence of fibrinopurulent exudate is documented in humans and experimental mouse model literature. Death occurs usually due to raised intracranial pressure and herniation. The count of red blood cells reaches to 24,600 per mm<sup>3</sup> and the white blood cells especially polymorph nuclear leukocyte varies from 300mm<sup>3</sup> to 26000mm<sup>3</sup>. The concentration of protein varies from 100mg to 1000mg/100 ml and glucose 10mg/100ml or lower<sup>6</sup>.

The diagnosis can be made by identification of specific nucleic acid and antigen for Naegleria fowleri. The rapid diagnosis can be made by directly visualizing the organism itself in a fresh CSF sample by using Giemsa Wright or modified trichome staining. In tissues, antibodies against its antigen are used involving immunofluorescence. In tissues or CSF, Polymerase chain reaction (PCR) can be used for DNA amplification. The amoeba can be grown in culture for direct visualization or by PCR. Unluckily, death occurs before the diagnosis is made. Approximately 75% of diagnosis is established after occurrence of death<sup>7</sup>.

Naegleria fowleri gains access to the human brain through nasal cavity during washing face or swimming<sup>4</sup>. The popularity of using mineral spas, hot springs,

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community baths and pools has been there since Roman times<sup>2</sup>. In Muslims countries, not only the exposure to recreational waters but also ritual ablution during Wuduh is also a risk factor for Naegleria fowleri infection. The ritual ablution involves repeated irrigation of the nostrils for cleansing purposes<sup>8</sup>.

Amphotericin B is considered as a drug of choice for PAM now a days but it has adverse effects on other systems and organs of the body. To check the efficacy of other drugs such as chlorpromazine and corifungin, studies have been conducted<sup>9</sup>. Miltefosine, a drug used for breast cancer and leishmaniasis, has shown good results against this amoeba which are hopeful for future cases<sup>7</sup>. The best way of prevention is to avoid water based activities in warm fresh waters. If it is not possible than preventive measures to avoid entry of water into mouth and nose should be taken such as wearing of a nose plug and ear plugs during swimming<sup>2</sup>. Use of boiled water at least for one minute and left to cool or filtered water for irrigation of nostrils<sup>9</sup>. WHO has recommended effective chlorination of water with concentration of residual free chlorine equal to and greater than 0.5mg/L after at least 30 minutes contact time, at 20°C and at PH less than 8.0<sup>7</sup>.

Pakistan especially Karachi being in a sub-tropical region has warm climate which is favorable for the growth of this amoeba. The first case of Naegleria was reported in 2008 in Karachi, after this number of cases are increasing over the years. In 2011, 13 cases of Naegleria were reported in Karachi. In 2014, one more case of this amoeba was reported<sup>7</sup>. Pakistan is a Muslim country where majority of the people practice ablution as a part of Wuduh while performing prayers and being a developing country, there is high rate of poverty and health facilities are still insufficient and not in the reach of all people. Lack of awareness, lack of education, lack of safe potable water supply and lack of sanitation, they all play a major role for spread of this amoeba in Pakistan. So there are chances that Naegleria fowleri cases will continue to its peak [3].

The primary objective of the study is to know the Knowledge, Attitude & Practices of young doctors in local tertiary care hospitals of Lahore about Naegleria Floweri.

**Rationale of the Study:** As Naegleria Fowleri has been rare amoeba found in Pakistan but as it causes a lethal disease, so this study was done to know young doctors knowledge about it and to know if these patients are being ruled out or not while assessing their patients. Pakistan is a developing Muslim country where majority of the people are suffering from poor health facilities, poor sanitation and lack of education and awareness. Being in a sub-tropical region, spread of Naegleria fowleri will be at its peak without the prior knowledge of its prevention and use of safe water supply.

**METHODOLOGY**

This descriptive Cross-sectional study was conducted at Gurkhi Hospital Lahore and CMH Hospital Lahore. Study population was M.B.B.S young doctors at GTTH (Gurkhi Trust Teaching Hospital) Lahore & M.B.B.S young doctors at C.M.H (Combined Military Hospital) Lahore. Random sampling technique was used. Sample size was 145 young doctors.

**Variables checked in the study:**

Independent variables: Age, gender,

Dependent variables: Qualification background & knowledge

**Data collection:** *Time Frame:* Almost four months, starting from Jan. to April 2018

**Data Collection Tool & Process:** A questionnaire for the study was prepared. The purpose of the study was explained and cooperation requested to conduct the study. Relevant literature search carried out through computerized literature searches of Medline, Embase, Pubmed, NORA, Google scholar Databases and manual search irrespective of the date of publication using MESH terms- 'MBBS doctors Knowledge, Attitude & Practice regarding Naegleria fowleri

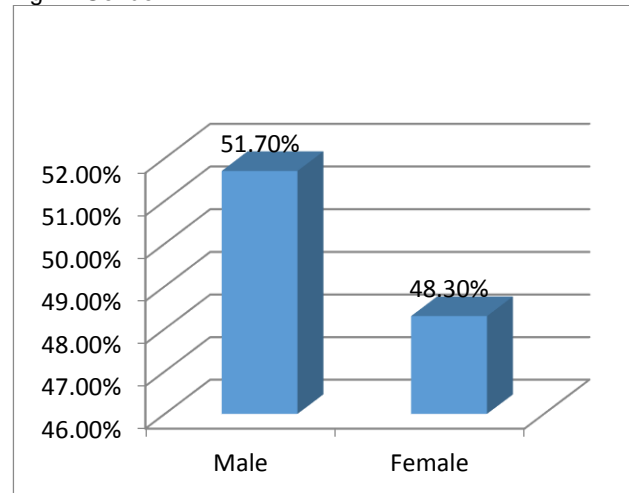
**Data Analysis:** Data analyzed using SPSS (Statistical Package for Social Science) version 20. A p-value of <0.05 taken as statistically significant.

**Ethical Consideration:** Done through Ethical Committee at Lahore Medical & Dental College.

**RESULTS**

Out of 145 questionnaires, all were returned back (response rate was 100.0%). Fig-1 shows the demographic characteristics of study population that includes 51.7% males and 48.3% females respectively. Nearly 60% were House Officers, 6.2% Medical Officers and 33.1% were PG Trainee. The educational background of young doctors at higher secondary level was found to be as 77.2 % who have done F.Sc, while 16.6 % had done A-Level and others which were not specified were found to be as 6.2 %. The age range as shown in Fig 1, was found to be from 23years to 53 years. The highest group of 25 years age was 27.6 % and the lowest age group of 0.7% was found to be in ages 31years, 37 years and 53 years respectively.

Fig. 1: Gender



Almost 82% young doctors answer back correctly about Naegleria and know it as Amoeba, however 6.9% know it as Bacteria and 2.8% as Virus. The exact knowledge about first ever Naegleria infection reported in Australia of 1965 was only known to 4.8% of total young MBBS doctors, however 44.8% of them wisely reported of

not knowing about it. The knowledge about Naegleria, city wise, most cases reported in Pakistan was correctly answered as Karachi by almost 57 %, however those who thought Lahore and that of Multan were 7.6% and 18.6%, still 16.6% were wise enough to say that they don't know the answer. 59% almost knew correctly that infection with Naegleria Fowleri occurs through warm fresh water and the optimum water temperature suitable for Naegleria Fowleri growth is up to 115F(46C) was correctly known by almost 47%.

To a more difficult question regarding the source of Nutrition for Naegleria Fowleri, almost 63% answered correctly that their nutrition is on the bacteria found in the sediment in lakes and rivers and not on viruses or other amoeba. 21.4% also said that the answer was not known to them.

<b>Knowledge, Attitude &amp; Practice of Naegleria</b>	
<b>Naegleria is a</b>	<b>%age</b>
Virus	2.8
Bacteria	6.9
Amoeba	82.1
Don't know	8.3
<b>2. When was the first ever infection reported in Australia</b>	
1965	4.8
1962	16.6
1971	33.8
Don't know	44.8
<b>3. Most of the cases reported in Pakistan were in</b>	
Lahore	7.6
Karachi	57.2
Multan	18.6
Don't know	16.6
<b>4. Infection with Naegleria fowleri occurs through</b>	
Drinking contaminated water	24.1
Water vapor or aerosol droplets	6.2
warm freshwater	59.3
Don't know	10.3
<b>5. The optimum water temperature suitable for Naegleria fowleri growth is</b>	
up to 115 F(46C)	47.6
Freezing	2.1
Temperature has no role	25.5
Don't know	24.8
<b>6. The source of Nutrition for Naegleria fowleri are:</b>	
Viruses present in water	4.8
Bacteria found in the sediment in lakes and rivers	63.4
Other amoeba	10.3
Don't know	21.4
<b>7. Naegleria fowleri infection can occur from a disinfected swimming pool?</b>	
No	17.2
Yes	64.8
Only in winters	17.9
<b>8. Naegleria fowleri infections most commonly occur in</b>	
January, February and March	6.9
July, August and September	60.7
October, November and December	15.2
Don't know	17.2
<b>9. Can Infections spread from one person to another?</b>	
Yes, in summers only	24.1
Yes, throughout year	27.6
No, Doesn't spread	28.3
Don't know	20.0

<b>10. The Infection caused by Naegleria Fowleri is called:</b>	
Primary amebic meningoencephalitis (PAM)	60.0
Post amebic meningoencephalitis (PAM)	20.0
Patent amebic meningoencephalitis(PAM)	2.8
Don't know	17.2
<b>11: The most common cause of death from Naegleria fowleri infection is:</b>	
Subcutaneous bleeding	6.9
Destruction of brain tissue	75.9
Bleeding per rectum	3.4
Don't know	13.8
<b>12: Fatality rate for an infected person who begins to show signs and symptoms is:</b>	
28 %	12.4
50 %	32.4
75 %	30.3
Don't know	24.8
<b>13: Naegleria fowleri infects people it enters the body through the:</b>	
Nose	48.3
Ears	14.5
Wounds	37.2
<b>14: Does pinching nose, use of nose clips, or keeping your head above the water when in a water-related activity prevent the spread of Naegleria Fowleri:</b>	
Yes	45.5
No	26.2
Don't Know	28.3
<b>15: Do you avoid water-related activities in warm freshwater during periods of high water temperature:</b>	
Yes	49.7
No	29.0
Don't Know	21.4
<b>16: Does posting sign boards around the swimming pool help to create awareness about Naegleria Fowleri:</b>	
Yes	73.8
No	6.9
Don't Know	19.3
<b>17: Can healthcare professional education be useful in spreading information regarding Naegleria Fowleri to the Community:</b>	
Yes	74.5
No	11.7
Don't Know	13.8

In the next section it was known incorrectly to large no of 64.8% young MBBS doctors that Naegleria Fowleri infection can occur from disinfected swimming pool and only 17.2% said that it will not occur. When asked about the months, almost 60% knew the right answer that infections with Naegleria Fowleri occur mostly in hot weather of July, August and September, in Pakistan. To the question that can infections spread from one person to another, only 28.3% responded correctly, saying No, doesn't spread and 27.6% said that Yes, throughout the year. No one seems clear on this as 24.1% marked it as Yes, in summers only. To the question that the infection caused by Naegleria Fowleri is called what? 60% ticked the right option that it is called Primary amebic meningoencephalitis (PAM), however 20% ticked on Post amebic meningoencephalitis, 2.8% ticked on Patent amebic meningoencephalitis and 17.2% ticked that they don't know. The exact answer to the most common cause

of death from Naegleria Fowleri infection was known correctly as destruction of brain tissue by 75.9% of young doctors. To the question that fatality rate for an infected person who begins to show signs and symptoms is how much, only 30.3% answered correctly as 75%, rest were divided among other incorrect options as 28%, 50% and Don't know. The correct answer to question that Naegleria Fowleri infects people when it enters through the Nose and not through ears or wounds was given by 48.3% young doctors. 45.5% answered correctly yes to the question that, does pinching nose, use of nose clips, or keeping your head above the water when in water related activity prevent the spread of naegleria fowleri.

In the last section of practices, 49.7% said correctly yes to question when asked that do you avoid water related activities in warm freshwater during periods of high water temperature, but still 29% said no to it. In another question when asked that does posting sign boards around the swimming pool help to cease awareness about Naegleria Fowleri, 73.8% said Yes, only 6.9% said No and 19.3% said Don't Know. On the question that, Can healthcare professional education be useful in spreading information regarding Naegleria Fowleri to the Community? 74.5% said Yes, 11.7% said No and 13.8% said Don't know.

Fig. 2:

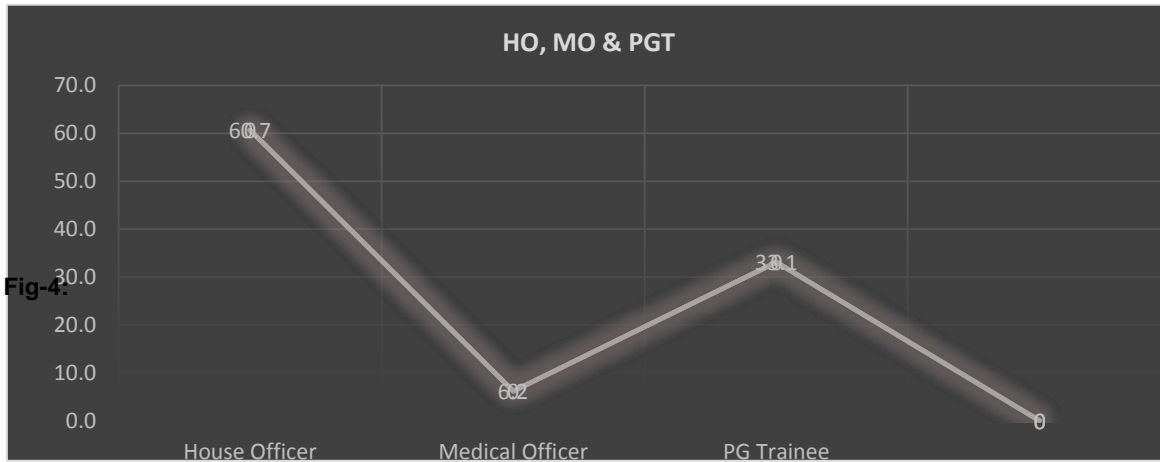
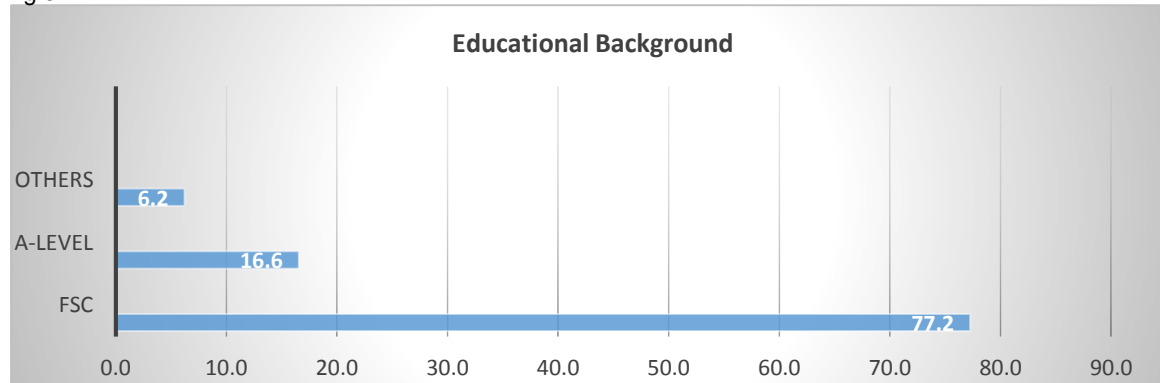


Fig.3:



**DISCUSSION**

N. Fowleri is the only species of its genus Naegleria which causes fatal infections to human brain. Owing to the rarity of infection and complexity in early recognition, about 75% of diagnoses are made following the death of patient. N.fowleri is not regarded as an opportunistic pathogen since it normally resides in persons. Indeed, PAM often prevails in immunologically strong children and adults during recreation in warm bodies of fresh water<sup>5</sup>. In this study, 45.5% considered that the infection is preventable. Community gets infected with N. fowleri if water having the amoeba goes into the body through nose and typically happens while swimming or diving in warm freshwater

places .N.fowleri amoeba then travels up the nose to the brain and destroys brain tissue. Research showed that infection cannot be initiated by drinking contaminated water [6]. In rare cases, infection can also occur when contaminated water from other sources (such as inadequately chlorinated swimming pool water or contaminated tap water) enters the nose, for instance, if people dip their heads or clean their noses in religious practices<sup>7,8</sup>. Our research also revealed the similar knowledge of doctors towards the occurrence of N. fowleri infection. In the current study, around 67% considered that the initial signs and symptoms of infection begin in 1–7 days whereas 37.3% believed that, after the onset of symptoms, the disease progresses rapidly and usually

results in death in 5–14 days. However, research has shown that the time from initial contact to the onset of illness is approximately 5–8 days but may be as short as 24 hours. The remarkable attribute of PAM is the speedy onset of symptoms subsequent to exposure. The disease progresses quickly, and, with no timely diagnosis and intervention, death typically occurs in a week or less<sup>9</sup>. In our study, 70% of students were acquainted with the fact that *N. fowleri* infection most commonly occurs in summer. *N. fowleri* is a thermophilic amoeba and consequently proliferates in water when the ambient temperature increases above 30°C. With the predictable temperature increase ensuing from global warming, it is likely that cases of *N. fowleri* PAM may be seen even in countries where it had previously not been reported<sup>10</sup>. Some of the initial symptoms include bifrontal or bitemporal headaches not responsive to analgesics and fevers ranging from 38 to 41°C<sup>11</sup>. A variation in taste or smell or even rhinitis can be apparent early<sup>12</sup>. Photophobia may occur shortly in the clinical course and may be followed by neurological abnormalities such as lethargy, confusion, seizures, coma, diplopia, or bizarre behavior<sup>9</sup>. On inquiring about the sign or symptom of infection in our study, the responses included fever (69.4%), severe headache (72.3%), stiff neck (39.2%), nausea and vomiting (54.1%), confusion (35.7%), loss of balance (27.4%), sleepiness (25.8%), seizures (31.5%), and hallucinations (18.8%). The infection destroys brain tissue causing brain swelling and death [5]. According to responses of students, patients who get an infection are most likely to die because of primary amoebic meningoencephalitis (28.02%), secondary amoebic meningoencephalitis (29.61%), brain hemorrhage (39.49%), and dehydration (2.86%). Our students (69.43%) considered that standard chlorination of swimming pools can prevent the spread and/or acquisition of an infection. Amoeba proliferation can be restricted by satisfactory chlorination of heavily used swimming pools, particularly during summer months as *N. fowleri* is susceptible to chlorine in water (one part per million)<sup>7</sup>. Local public health authorities should monitor recreational waters for *N. fowleri* amoebae and appropriate warnings should be posted, particularly in high-risk areas. A number of drugs have been found to be effective against *N. fowleri* in vitro. Though, their usefulness is uncertain in view of the fact that nearly all infections have been lethal, even when people were treated with analogous drug combinations<sup>3</sup>. There are only four recognized survivors in North America: one from the USA in 1978, one from Mexico in 2003, and two from

the USA in 2013<sup>13</sup>. In the current study, nearly half of the population (48.4%) did not know whether *N. fowleri* infection can be cured or not.

## CONCLUSION

It is concluded that young MBBS doctors were having adequate awareness of *N. fowleri* infection and considered it as a serious health issue that necessitates instantaneous steps by the government to prevent the general public from this fatal neurological infection.

**Recommendations:** Health authorities should adopt such policies that assure prevention of this disease. One major step is to make sure that the water supply to the city should be chlorinated according to suggested standards. The doctors should recommend that appropriate methods for prevention should also be projected in the community from time to time that increase public awareness about the associated risk factors.

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