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# THE LEVEL OF KNOWLEDGE ABOUT TOXOPLASMOSIS AMONG HEALTH PERSONNEL

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*Abstract*
**Background:** Toxoplasma gondii is a protozoan parasite that lives inside host cells and relies on them for survival. Humans can contract the infection through the ingested food contaminated with infectious ova from cat feces, which serve as the definitive host. Additionally, infection can occur by consuming undercooked meat, such as pork or lamb, from intermediate hosts that contain tissue cysts.
aim of this study: The objective of our study is to assess the awareness of healthcare personnel regarding toxoplasmosis, including its modes of transmission, clinical symptoms, diagnostic methods, and preventive measures.
**Persons & Methods**: A cross – sectional study was conducted between December in 2023 to March in 2024, in Al-yarmokgeneral hospital in Baghdad capital of Iraq. The study sample was health personnel working in this hospital including skilled nurses, technical Nurse, university nurses and allied profession
**Results** :The results of the statistical analysis that we conducted in 2024 indicate that the proportion of male respondents was (33%) of the total study sample, while the proportion of females was (67%) for the (aware about toxoplasmosis) group, while the male proportion was (60%) and the female proportion was (40%) for the group (unknown about toxoplasmosis. The results of the statistical analysis indicated that the percentage of people responding in the age (20-30) was higher than the percentage of the (aware about toxoplasmosis) and (un aware about toxoplasmosis) groups .
**Conclusions**: The findings of this study revealed a low knowledges level about toxoplasmosis among healthcare personnel. This highlights the need for educating healthcare workers on essential knowledge and hygienic practices to prevent infection. Implementing health education programs in group settings, such as universities, hospitals, and workplaces, would be an effective approach to achieving this goal.
**Key words:** Knowledge ,Toxoplasmosis , Health ,Personnel
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## Introduction

Toxoplasma gondii (T. gondii) is protozoan parasite which relies on a host to survive. Humans infected by eating something contaminated with infectious oocysts from cat feces (the definitive host) or by consuming undercooked meat from intermediate hosts like pork or lamb, which contains tissue cysts. [1,2,3]. Toxoplasmosis is a global parasite infection caused obligation of intracellular parasite T. gondii . It is estimated that around 1\3 of the global population carries this parasite. The prevalence of T. gondii varies significantly across different regions and populations, ranging from less than 10% to nearly 100%. [4, 5]. While toxoplasmosis is usually mild and symptomless, it can cause serious complications in immunocompromised persons and in pregnancy, potentially resulting in abortion and congenital disorders. [6]. Congenital toxoplasmosis poses a significant public health challenge globally [7].Preventive measures rely on women's understanding of toxoplasmosis. As there is not currently vaccine for T. gondii, preventing the primary infection in pregnant women is crucial to avoid congenital T. gondii infections and associated complications[8]. Previous research has indicated varying levels of awareness between pregnant women regarding the risks and effects of toxoplasmosis to pregnancy. However, it is still debated whether enhancing knowledge and providing accurate information about infection sources can effectively influence s behavior of women during pregnancy. [9, 10].

## Aim of study

The aim of study was to evaluate the level of knowledge on toxoplasmosis, infective agent, transmission and other epidemiological factors, among
Health Personnel working in General Hospital in Baghdad , Capital of Iraq.

**Methodology**

Our study is a cross-sectional descriptive research conducted at Al Yarmok General Hospital in Baghdad, the capital of Iraq. It was carried out over a period from December 1, 2023, to March 1, 2024.

The study sample consisted of healthcare personnel working in the hospital, including skilled nurses, technical nurses, university nurses, and allied professionals. A total of 80 participants were selected using convenience sampling.

The inclusion criterion was the willingness of the mentioned healthcare personnel participation in the study. The criteria of exclusion include individuals who were not healthcare personnel and healthcare workers who declined participation.

Data were collected using a questionnaire designed by researchers in collaboration with their supervisor. The questionnaire covered personal information, job-related details, and aspects related to toxoplasmosis, including its causative agent, epidemiology, and other relevant data. Students enrolled in the study were responsible for distributing and collecting the questionnaires, with each student handling 10 copies. The study received approval from the Department's Scientific Committee, the training center of the Ministry of Health, and the participating administrations healthcare institutions. All data were collected anonymously and securely stored.

**Results**

The results of the statistical analysis that we conducted in 2024 indicate that the of percentage male respondents was (33%) of the total study sample, while the percentage of females was (67%) for the (aware about toxoplasmosis) group, while the percentage of males was (60%) and those of females was (40%) For the group (unknown about toxoplasmosis), as shown in

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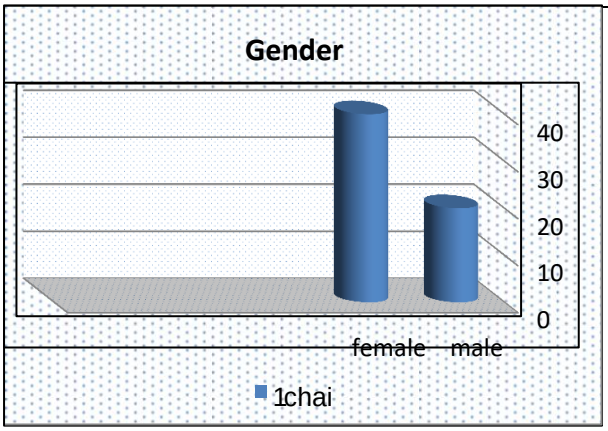
Table (1). The results of the statistical analysis indicated that the proportion of people responding in the group of age (20-30) was higher than the percentage of the (Aware about .toxoplasmosis) and (Un aware about toxoplasmosis) groups.
Statistical analysis was done by descriptive statistics, numbers, percentage, tables and figures.

1-Gender variable

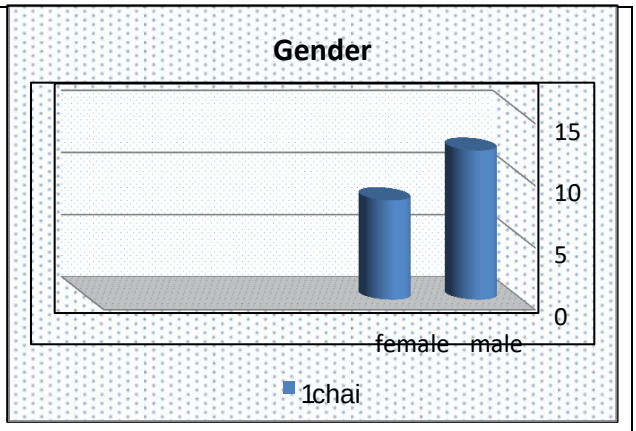
Table (1) shows the genders of the people in the research sample

| *Un-Aware about Toxoplasmosi* | | *Aware about Toxoplasmosis* | | *Gender* |
|---|---|---|---|---|
| *percentage* | *Frequency* | *percentage* | *Frequency* | |
| *0.6* | *12* | *0.33* | *20* | *Male* |
| *0.4* | *8* | *0.67* | *40* | *Female* |
| *%111* | *20* | *%100* | *60* | *Total* |




*Aware about Toxoplasmosis*

*figure (1)*




*Un-Aware about*

*figure (2)*

The results of the statistical analysis of Table (1) above indicate that the percentage of people responding were male (33%) of the total study sample, while the percentage of females was (67%) for the (Aware about Toxoplasmosis) group, while the proportion of males was (60%). The proportion of females is 40% for the Un-Aware about Toxoplasmosis group. These percentages can be clarified according to the following graph:

Age variable

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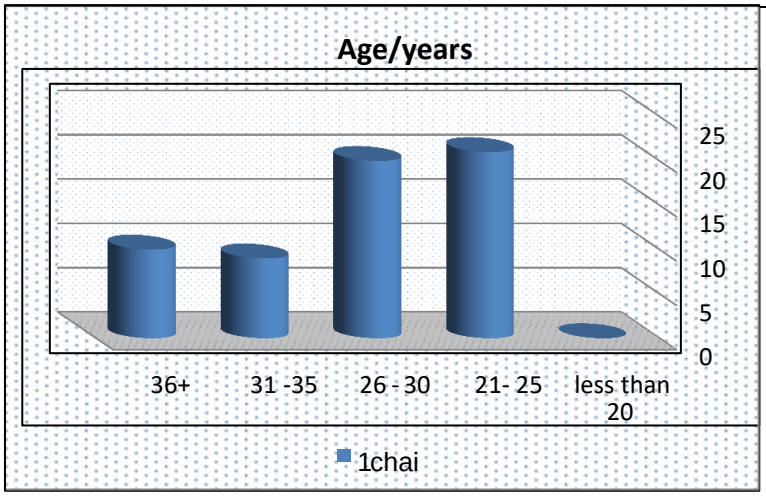
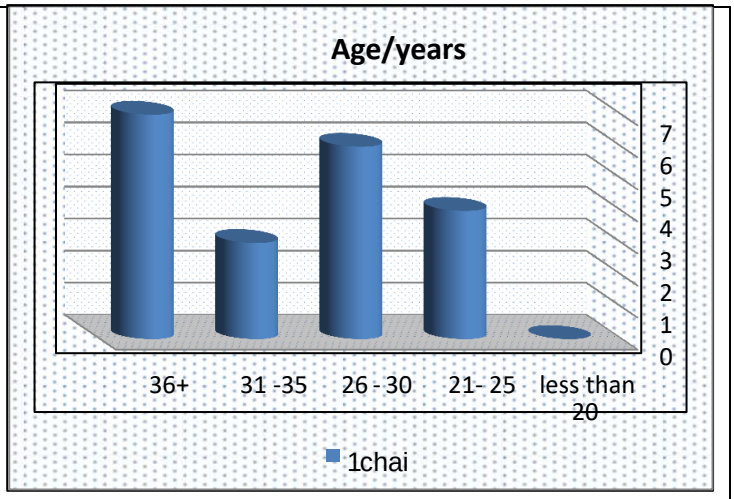
Table (2) shows the ages of the people in the research sample

| *Un-Aware about Toxoplasmosi* | | *Aware about Toxoplasmosis* | | *Age/ Years* |
|---|---|---|---|---|
| *percentage* | *Frequency* | *percentage* | *Frequency* | |
| *0* | *0* | *0* | *0* | < +20 |
| *0.2* | | *4* | *0.35* *21* | *21- 25* |
| *0.3* | | *6* | *0.33* *20* | *26 - 30* |
| *0.15* | | *3* | *0.15* *9* | *31 -35* |
| *0.35* | | *7* | *0.16* *10* | *36+>* |
| *%111* | | *20* | *%100* *60* | *Total* |




**aware about Toxopasmosis**

*figure (3)*




**un-aware about Toxopasmosis**

*figure (4)*

*The results of the statistical analysis of Table (2) indicate that the percentage of people responding from the age group mentioned above, along with the frequency and percentage value for each of them, out of the total study sample for the (Aware about Toxoplasmosis) group, and for the (UnAware about Toxoplasmosis) group, and this can be clarified The proportions are according to the following graph:*

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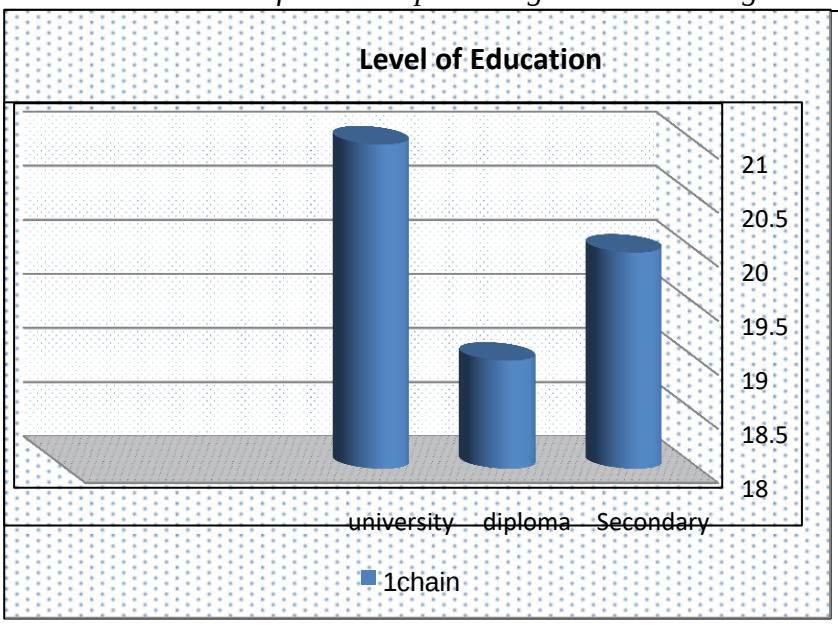
*Education level variable – 3*

*Table (3) shows the level of education of the people in the research sample*

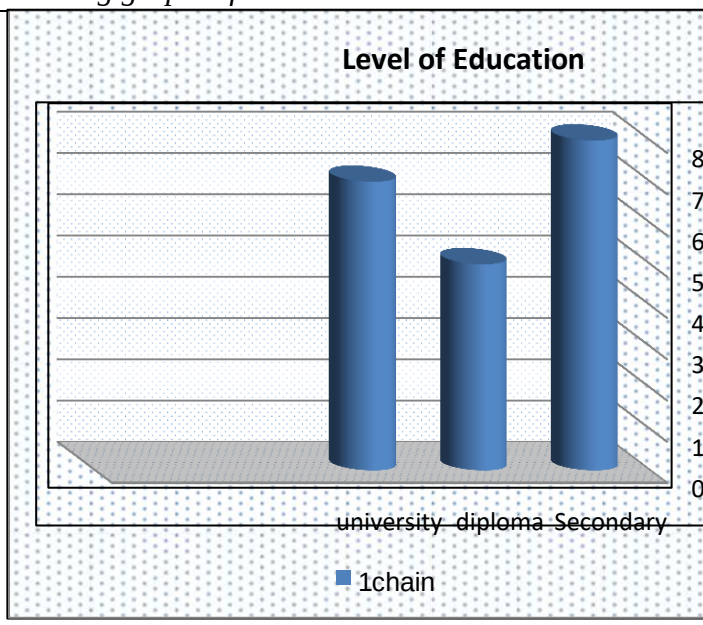
| *Un-Aware about Toxoplasmosi* | | *Aware about Toxoplasmosis* | | *Level of Education* |
|---|---|---|---|---|
| *percentage* | *Frequency* | *percentage* | *Frequency* | |
| *0.4* | *8* | *0.33* | *20* | *Secondary* |
| *0.25* | *5* | *0.31* | *19* | *Diploma* |
| *0.35* | *7* | *0.35* | *21* | *University&more* |
| *%111* | *20* | *%100* | *60* | *Total* |

*The results of the statistical analysis of Table (3) above indicate that the percentage of people responding, according to the educational level mentioned above, with the value of the frequencies and percentages for each of them out of the total study sample for the (Aware about Toxoplasmosis) group, and for the (Un-Aware about Toxoplasmosis) group, and it can be clarified These percentages are according to the following graphic form:*




**aware about Toxopasmosis**

*figure (5)*




**un-aware about Toxopasmosis**

*figure (6)*

*Job description variable – 4*

*Table (4) shows the job descriptions of the people in the research sample*

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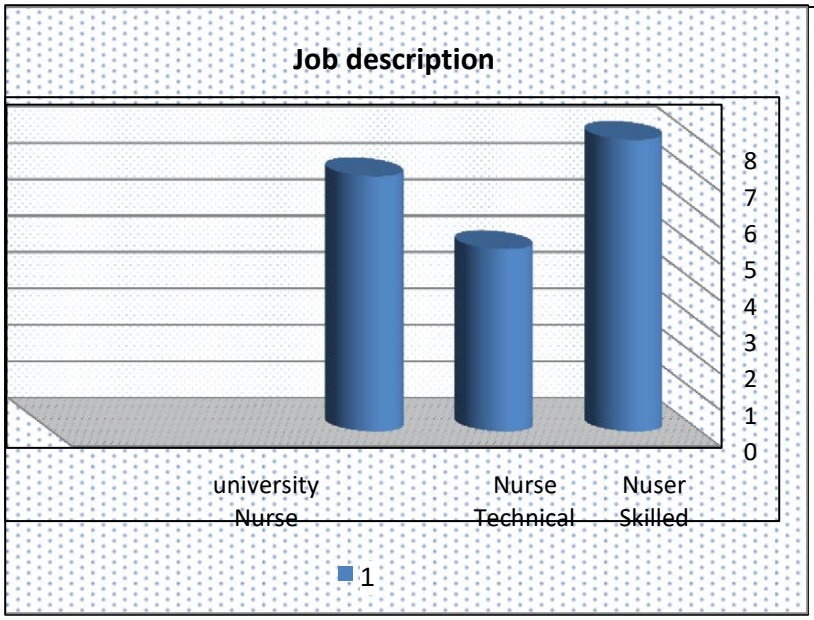
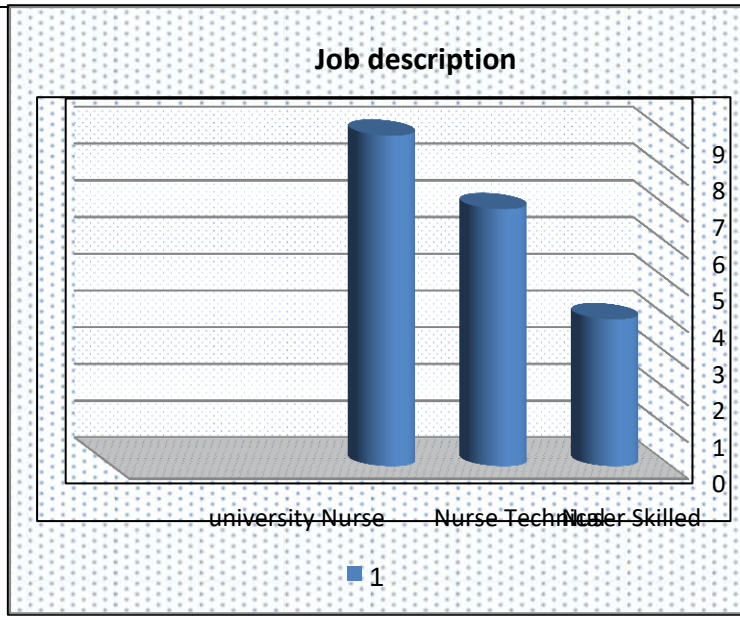
| *Un-Aware about Toxoplasmosi* | | *Aware about Toxoplasmosis* | | *Job description* |
|---|---|---|---|---|
| *percentage* | *Frequency* | *percentage* | *Frequency* | |
| *0.2* | *4* | *0.31* | *19* | *Nurse Skilled* |
| *0.35* | *7* | *0.33* | *20* | *Nurse Technical* |
| *0.45* | *9* | *0.35* | *21* | *University Nurse* |
| *%111* | *20* | *%100* | *60* | *Total* |

*The results of the statistical analysis of Table (4) above indicate that the percentage of people responding, according to the job description mentioned above, with the value of frequencies and percentages for each of them out of the total study sample for the (Aware about Toxoplasmosis) group, and for the (Un-Aware about Toxoplasmosis) group, and it can be clarified These percentages are according to the following graphic form:*




**aware about Toxopasmosis**

*figure (7)*




**un-aware about Toxopasmosis**

*figure (8)*

*Scientific department variable – 5*

*Table (5) shows the ages of the people in the research sample*

| *Un-Aware about Toxoplasmosi* | | *Aware about Toxoplasmosis* | | *Department* |
|---|---|---|---|---|
| *percentage* | *Frequency* | *percentage* | *Frequency* | |
| *0.2* | *4* | *0.25* | *15* | *Medical* |
| *0.1* | *2* | *0.23* | *14* | *Surgical* |

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| | | | | |
|---|---|---|---|---|
| *0.3* | *6* | *0.13* | *8* | *Emergency* |
| *0.15* | *3* | *0.18* | *11* | *Lab* |
| *0.25* | *5* | *0.2* | *12* | *Other* |
| *%111* | *20* | *%100* | *60* | *Total* |

*The results of the statistical analysis of Table (5) above indicate that the percentage of people responding, according to the scientific department variable mentioned above, with the value of the frequencies and percentages for each of them out of the total study sample for the (Aware about Toxoplasmosis) group, and for the (Un-Aware about Toxoplasmosis) group*

***Table (6) : Answers to Knowledges related to the epidemiology and infectious agent , diagnosis , and clinical items of toxoplasmosis in health personnel included in the study .***

| *Variables/Knowledge about toxoplasmosis* | *Correct response* | | | *Rank* |
|---|---|---|---|---|
| | *Mean* | *Std.Deviation* | *C.V* | |
| *Infective agent* | *4.36* | *.805* | *18%* | *2* |
| *Mode of transmission* | *1.77* | *.579* | *32%* | *4* |
| *Congenital Toxo* | *1.73* | *.578* | *33%* | *5* |
| *Diagnosis* | *4.54* | *.748* | *16%* | *1* |
| *Presence of vaccine* | *1.90* | *.815* | *42%* | *7* |
| *Symptoms of Disease* | *1.65* | *.976* | *59%* | *8* |
| *Who at risk Group* | *4.26* | *.971* | *22%* | *3* |
| *Disease complication* | *2.60* | *1.125* | *34%* | *6* |

*The findings of the statistical analysis revealed the answers of the sample members through the use of the average trend and based on the percentage of the coefficient of variation, and as shown in Table No. (6) that the fourth paragraph, represented by (Diagnosis), the first paragraph (Infective agent), and the seventh paragraph (Who at risk Group) came in the ranks The first three are respectively (4.26, 4.36, 4.54) and with a standard deviation of (0.917, .8050, .7480), respectively. These items represent a high positive trend and are the most important in influencing the research sample's level of awareness of the importance of this variable.*

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***Table (7) : Answer to Knowledge related to the epidemiology and infectious agent, diagnosis , and clinical aspects of toxoplasmosis among health personnel included in the study:***

| | Job description | | |
|---|---|---|---|
| | Chi-Square $\chi^2$ | Spearman Correlation | p-value |
| Infective agent | 6.136 | -.090 | 0.002 |
| Mode of transmission | 12.041 | -.160 | 0.044 |
| Congenital Toxo | 3.640 | -.100 | 0.301 |
| Diagnosis | 2.917 | .040 | 0.042 |
| Presence of vaccine | 1.850 | -.050 | 0.763 |
| Symptoms of Disease | 11.366 | .123 | 0.230 |
| Who at risk Group | 5.462 | -.062 | 0.231 |
| Disease complication | 2.190 | -.066 | 0.701 |

*The results of the analysis showed, through the use of the (Chi-Square test) that the probability value (p-value) for the first, second, and fourth paragraphs was less than the value of the significant level (0.05), and this indicates the presence of a statistical significant relationship, in addition to values of Spearman Correlation test. ) for each of the values of the paragraphs above.*

## *Discussion*

*The key finding of this study was 33% of the participants were aware of toxoplasmosis, with females comprising 67% of this group. Conversely, among those unaware of the disease, 60% were male and 40% were female. Increasing awareness and knowledge of toxoplasmosis is essential in minimizing risk of congenital infections.*

*A separate study evaluated awareness of this disease in medical, biology and veterinary students, showing that 42.6% of university students were informed about the disease. This awareness level is notably higher compared to findings from Egypt (20.9%) ,Iran (15.7%), Saudi Arabia (28% and 20.9%).[13,14], and recently in Egypt (3.2%) [16]. However, our percntage is lesser than that resulted in Yemen (50%) [12] and in Jordan (51.1%) [15]. The various target populations in the studies and the cultural and economic contexts of each country can cause this variation in the knowledge of the disease. (75.8%)of students who were previous aware of toxoplasmosis reported they gained their knowledgent in the classroom during studing. Similar studies have noted differenc information sources. For example, in Yemen, Alnaggar et al. (2010) found half of the students learned about toxoplasmosis from internet. Likewise, study of Saudi Arabia indicated (55.5%) of respondents obtained the information by online. In contrast, in 2013 study of Iran reported*

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*books were the primary referance of information for participants, with 55.8% relying on them[16].*

*Also we examined the relationship among genders and students' knowledge of the disease. A higher percentage of female students (47.2%) were aware of the disease compared to male students (36.9%). This finding contrasts with earlier studies, such as Nematollahi et al. (2011), which reported that male students had a higher knowledge rate (41%) than female students (13.9%). As similar as, Ebrahimi et al in 2015 found that more male (17.3%) were find of the disease than female (13.8%). These findings may reflect the culture in every country compared to Morocco[17].*

*Regarding the correlation between education level and knowledge about disease, we discovered that students at undergraduate levels and those in master degree were more knowledgeable about toxoplasmosis than those in other stages of education. This contrasts with findings by Ebrahimi et al. who suggested that about 10% of participants believed students of PhD knew the most about the these illness. This discrepancy might be due to the master's curriculum, which includes extensive parasitology content[18].*

*In our study about 36.5% identified the disease is resulted by the T. gondii parasite, and 32.2% recognized definitive host as the cat. Those figures are less than those from studies in Iran and Yemen, where 50% of them knew that toxoplasmosis is a parasitic disease transmitted by T. gondii, and about 64% were knew that the most definitive host is the cat. Opposite to Saudi Arabia, only 25.1% and approximately 50.25% of them knew the causative agent and transmission by the role of cats [19].*

*We also compared students' knowledge and perceptions regarding the various ways of transmission of toxoplasmosis and found a diffrence in awareness in university students. Approximately 30% correctly identified the oral route as the primary mode of transmission, with major risk factors including the undercooked meat consumption or contaminated food and direct contact with pets[20]. This finding is less than results from other studies; for instance, around 54% of university students in Iran correctly identified the oral way as the higher significant for transmission. Another study in Iran of female students reported that 72.5% recognized the consumption of undercooked meat as a key transmission route[21]. Cook et al. (2000) also noted that dietary routes are the primary means of toxoplasmosis transmission. Furthermore, only 33% of university students acknowledged that pets are the root of environmental contamination[22]. An Iran study indicated that just 19.4% of students identified correct contaminated with pet feces as the primary route. Climate factors significantly impact the survive ova in the environment and the infection rates in animals meat, with tropical, humid countries typically showing higher prevalence than arid or cold regions.*

*In this study, only 13.9% of students believed strongly that toxoplasmosis could be transmitted in untreated water. This perception aligns with findings from other regions; for example, Alrashada et al. reported about 51.3% of women students recognized tank of water for drinking as a causetive factor for transmission. A 2004 France studys established a relation between the presence of anti-T. gondii antibodies and consumption of unboiled water particularly in farms with poor hygiene. Recently, T. gondii was detected in public water for drinking in Mexico, highlighting that toxoplasmosis can be contracted from water for drinking contaminated with resistant oocysts, which are not effectively eliminated by standard disinfection methods like chlorination[15].*

*Approximately 24% of students indicated that the diagnosis of toxoplasmosis primarily relies on detecting IgM antibodies and anti-T. gondii IgG, while 29.5% were aware that avidity*

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*test can date the infection during early pregnancy. It's important to notice that IgM detection is not always sufficient to confirm a new infection. However, the avidity test is effective in ruling out active toxoplasmosis. Sadak and Laboudi made a study in the Rabat area in Morocco and found that using the avidity test on IgM-positive serum samples helps exclude recently acquired toxoplasmosis in first trimesterof pregnant women [19].*

*When asked around the availability of toxoplasmosis vaccine in human, about 14.7% of students correctly answered( no vaccine) is currently available publicly. This proportion is less than found by Ansari-lari et al., where about 46% of women students believed vaccination could prevent disease. While vaccination is theoretically possible due to the strong immune response seen with natural infections, currently available vaccines for animals, such as a live attenuated vaccine for sheep, are focused on preventing toxoplasmis that cause miscarrage. In the absence of human vaccine, following most preventive measures is essential to manage toxoplasmosis by minimizing exposure to ova and cysts of tissue [16].*

*The recent study found that about 18.7% of respondents knew what seroconversion, while 32.6% understood the definition of congenital disease. These results suggest confusion between congenital toxoplasmosis and the means of seroconversion. Then seroconversion occurs when IgG antibodies to T. gondii develop in pregnant women, noticed by a significant ascent in IgG titers and the detection of IgM antibodies[20]. In contrast, congenital toxoplasmosis refers to the transmission of the parasite from mom to fetus during pregnancy. Unfortunately, the most participants seemed unclear about the period of big transmission and severity during pregnancy that affects the baby, with only about 14% correctly identifying this timing across the trimesters[10]. The largest transmission rate typically occurs during the third trimester, while the most severe effects on the fetus, if transmission occurs, are found in the first trimester when the placental barrier is thicker and becomes thinner as pregnancy progresses. Less than 50% of the students understood that toxoplasmosis is an opportunistic disease in immunocompromised individuals[17].*

## *Conclusions*

*The present study demonstrated a low level of knowledge about toxoplasmosis of healthcare personnel. This underscores the importance of educating healthcare workers on essential knowledge and hygienic practices necessary to prevent infection. Implementing health education programs in group settings, such as universities, hospitals, and workplaces, would be an effective strategy for addressing this issue.*

*Additionally, further studies with larger sample sizes are recommended to include a broader range of occupations, workplace settings, healthcare institutions, and academic faculties.*

*Findings from our 2024 study indicate that male respondents comprised 33% of the total study sample, while females accounted for 67% in the group categorized as "aware of toxoplasmosis." Conversely, in the group classified as "unaware of toxoplasmosis," males made up 60%, while females represented 40%.*

***Recommendations***

*Educational sessions, advocacy meetings, and awareness campaigns should be conducted to promote knowledge about toxoplasmosis and its decreasing prevalence, particularly among women of childbearing age and healthcare personnel.*

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*Since there is currently no approved vaccine for human toxoplasmosis, raising awareness of preventive measures remains the primary approach to controlling the disease. Educating students—who represent the next generation of healthcare professionals—on various aspects of toxoplasmosis is crucial for eliminating misconceptions and fostering widespread awareness among the general public.*

*The decline in toxoplasmosis prevalence is associated with a reduction in disease incidence, likely due to decreased parasite exposure, shifts in dietary habits, and improved hygiene. Toxoplasma gondii is transmitted to humans through three main pathways:*
*(a) consuming undercooked meat containing tissue cysts from intermediate hosts;*
*(b) ingesting sporulated oocysts from contaminated soil, water, or food exposed to feces from infected cats and other felines, which are the definitive hosts;*
*(c) vertical transmission, which can cause congenital toxoplasmosis, potentially leading to fetal death, stillbirth, or severe ocular and neurological issues such as retinochoroiditis, hydrocephalus, and intracerebral calcifications.*

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