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Toxoplasmosis-Related Knowledge and Preventive Practices among Undergraduate Female Students at An-Najah National University, Palestine

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Abstract

Toxoplasmosis is a worldwide zoonotic infectious disease that has serious health consequence in infected females**.** There is a scarcity of data about female's knowledge and perception of *Toxoplasmosis* in Arab world in general and in Palestine in particular. Therefore, the objective of this study was to assess *Toxoplasmosis* related knowledge and preventive practices among undergraduate female students.

A cross-sectional, non-interventional, descriptive study design was used. A convenient sample of undergraduate females attending An-Najah National University, Nablus, Palestine were chosen. We used a previously published questionnaire to achieve the objectives of the study.

A total of 976 undergraduate university females aged 18-23 were recruited. About half of the female students (503; 51.5%) reported having ever heard, read or seen any information about *Toxoplasmosis*, and approximately (905; 92.7%) had never been tested for *Toxoplasmosis*. There was a lack of perception and insight about risk factors, symptoms, timing of infection, and preventive knowledge and practices regarding *Toxoplasmosis*. However, high rates of females reported a high level of hygienic practices including hand washing after dealing with cat litter, treating raw meat and gardening.

Our study showed inadequate knowledge about *Toxoplasmosis* among young females in Palestine. Awareness campaigns are needed to educate females in reproductive age about health consequences and preventive practices to avoid potential infection with *Toxoplasmosis*.

Keywords:
Toxoplasmosis,
Palestine,
University female students,
Knowledge,
Practices.

1. Introduction:

Toxoplasmosis is a worldwide zoonotic infectious disease caused by *Toxoplasma gondii (T. gondii*) (Petersen, Vesco, Villari, & Buffolano, 2010). The seroprevalence of *T. gondii* varies according to age, geographical area, climate, culture, eating habits, animal husbandry and socioeconomic status of a certain population (Moncada & Montoya, 2012; Torgerson & Macpherson, 2011). Seroprevalence is determined by the extent of exposure to risk factors such as dealing with cat feces, soil, contaminated water, ingestion of raw meat and unwashed vegetables and fruits(Jones et al., 2001; Moncada & Montoya, 2012). The risk for infection from cats is related to exposure to feces from a cat that

is infected and sheds oocysts (Paquet et al., 2013). The oocysts become infective in the environment and remain infectious for long periods in soil or water (J. P. Dubey, 2016; Schlüter et al., 2014). Many humans and warm-blooded animals serve as intermediate hosts (J. P. Dubey, 2016; Schlüter et al., 2014).

One of the major complications of *Toxoplasmosis* infection during pregnancy is vertical transmission to the fetus (Roberts & Alexander, 1992). *T. gondii* infection in pregnant women may lead to abortion, neonatal death or different congenital defects, such as central nervous system aberrations, chorioretinitis, and reduced intelligence or in some cases to schizophrenia (Dogruman-Al, Aslan, Yalcin, Kustimur, & Turk, 2009; J. Dubey, 2004; Montoya & Rosso, 2005). *T. gondii* is an important cause of bad obstetric history leading to habitual abortions and now its role as a cause of infertility has also been recognized (Malik et al., 2014). Therefore, *Toxoplasmosis* is a serious disease which brings adverse effects to the fetus, mother, family and off course the society as a whole (Havelaar, Kemmeren, & Kortbeek, 2007). Female university students are a high risk group since they are at reproductive age and tend to have pets, like cats, at home.

There is lack of data about women's knowledge and perception of this disease. The goal of this research was to actuate toxoplasmosis knowledge and preventative practices of young childbearing age women in Palestine. Therefore, the objective of this study was to assess *Toxoplasmosis*-related knowledge and preventive practices among undergraduate female students in An-Najah National University in Palestine. The data of this research will climax the need for toxoplasmosis awareness and preventive education in childbearing females. An effective education and outreach program should cover vital topics concerning risk factors, high risk foods, and precautionary measures of toxoplasmosis. This study will be the first of its kind to establish baseline data about awareness levels of toxoplasmosis among young women in Palestine.

2. Methodology:

A cross-sectional non-interventional, descriptive study design was used. A convenient sample of female undergraduate university students from all years of study and several departments at An- Najah National University was chosen. Students from both campuses (the old campus and the new campus) were recruited to evaluate their knowledge and preventative practices of *Toxoplasmosis*. These students came from different geographical regions including different cities, villages and camps all over Palestine. We approached eligible students during class breaks and explained the study objectives. Then, when students showed interest in participating in the study, they were asked to complete a questionnaire in Arabic about knowledge and practices to prevent *Toxoplasmosis*. The research was approved by the Institutional Research Bioethics committee of An-Najah National University.

A convenient sampling approach was used for selection of students. The sample size was calculated based on a response rate of 50% and a total population size of 10,000 students. The online Roasoft online calculator gave us a minimum required sample size of 380. In order to have a greater assurance in generalizing the findings to all young university students in Palestine, it was decided to increase the number of surveyed students to 1000.

The questionnaire used in this study was taken from a previously published study after obtaining approval of the authors (Al-Sheyab, Obaidat, Bani Salman, & Lafi, 2015a). A pilot study of 50 undergraduate female students was done to examine the clarity and time needed to finish the questionnaire to determine if any changes were needed. All students completed the questionnaire within 5 minutes and had no difficulty answering the questions. The questionnaire was not tested for validity or reliability before. However, it was previously used in similar publication by researchers in Jordan (Al-Sheyab, Obaidat, Bani Salman, & Lafi, 2015b). A checklist accompanied the questionnaire to extract information about the socio-demographic characteristics of participating females including age, residency in city, village, or camp areas and if they owned pets. The questionnaire was composed of 37 "yes, no, not sure" questions in three subscales in order to identify women's knowledge about *Toxoplasmosis*, risk factors, symptoms, and knowledge about preventative practices and behaviors. An additional two questions in subscales were added to obtain information about the general knowledge among Palestinian women. The achieved results from the questionnaire were entered into Statistical Package of Social Sciences (SPSS) version 20 software for further analysis. Answers of female students were entered in SPSS, and the results were displayed into tables. Participants' information for this study remained confidential and within the institution. Data were entered into and stored in a Microsoft Excel

spreadsheet. Descriptive statistics using frequencies and percentages were used to identify participants' knowledge of and preventative practices for toxoplasmosis. Chi-square (χ^2) test was performed to examine the relationship among the categorical variable including the relationships between the different characteristics of participants with all questions included in the questionnaire. In all statistical analyses, a p-value ≤ 0.05 was considered statistically significant.

3. Results:

3.1 Personal information:

976 female students were surveyed between 18-23 years of age with a 100% response rate. About one third (355; 36.4%) of surveyed females were students at faculties of Science and Engineering while approximately two thirds (621; 63.6%) were students at faculties of Humanities, Fine Arts, and Economics. Less than half (411; 42.1%)of surveyed females reported owning a pet at their residence. Surveyed participants were living in cities (393; 40.3%), villages (488; 50%), and camps (95; 9.7%) (Table 1).

Table 1 *Personal information*

Faculty	**Science and Engineering**	**Humanities/FA/E**	**Total**
	355 (36.4%)	621 (63.6%)	976 (100%)
Pet Owner	**Yes**	**No**	**Total**
	411 (42.1%)	565 (57.9%)	976 (100%)
Permanent residence	**City**	**Village**	**Camp**
	393 (40.3%)	488 (50%)	95 (9.7%)

3.2 General information and knowledge:

Results showed that (418; 42.8%)of students knew the answer for the question "how your body would be affected if you had *Toxoplasmosis"* and (274; 28.1%)of student knew "what groups of people are at the highest risk of getting *Toxoplasmosis"*. About half of students (503; 51.5%) reported 'ever' hearing or reading information about *Toxoplasmosis* and almost all students (905; 92.7%) had never been tested for *Toxoplasmosis* and (33; 3.4%) were not even sure if they were tested. Half of the student (503; 51.5%) knew that *Toxoplasmosis* causes recurrent miscarriages in women.

Approximately one third (321; 32.9%) of the students knew that *Toxoplasmosis* was caused by infection and (480; 49.2%) of them knew that it was not caused by a poison. One fifth were unsure whether *Toxoplasmosis* was caused by an infection or a poison. At the same time, a reasonable percentage (503; 51.5%) knew that *Toxoplasmosis* was associated with cat feces. Nearly half (454; 46.5%) of the participants wrongly thought that *Toxoplasmosis* causes miscarriages in women. Additionally, only (363; 37.2%) of the participants knew that raw or undercooked meat can cause *Toxoplasmosis* (Table 2).

The relationships between the different characteristics of participants (cat ownership, and living area) with all questions about knowledge included in the questionnaire (questions 5-14) showed no significant relationships (p more than or equal to 0.05) using Chi-Square analysis. Surprisingly; knowledge and preventive practices did not show any statistical significance with cat ownership and with residency (*p* more than or equal to 0.05).

Table 2 *General information and knowledge*

Question	**Flue like symptoms**	**Miscarriage**	**Neurologic symptoms**
How would your body be affected if you had *Toxoplasmosis*؟	418 (42.8%)	415 (42.5%)	143 (14.7%)
	Newborn babies	**Immunocompromised patients**	**Pregnant women**
Who is most likely to become sick with *Toxoplasmosis* gondii؟	264 (27.1%)	274 (28.1%)	437 (44.8%)
	Yes	**No**	**Not sure**
-Have you ever read, heard or seen any information about *Toxoplasmosis*?	388 (39.8%)	503 (51.5%)	85 (8.7%)
Have you ever been tested for *Toxoplasmosis*?	38 (3.9%)	905 (92.7%)	33 (3.4%)
Is *Toxoplasmosis* caused by an infection?	321 (32.9%)	301 (30.8%)	354 (36.3%)

Is *Toxoplasmosis* caused by a poison?	216 (22.1%)	480 (49.2%)	279 (28.6%)
Is *Toxoplasmosis* (*Toxoplasma gondii*) shed in the feces of infected cats?	503 (51.5%)	185 (19%)	288 (29.5%)
Is *Toxoplasmosis* (*T. gondii*) sometimes found in raw or undercooked meat?	363 (37.2%)	304 (31.1%)	308 (31.6%)
Does *Toxoplasmosis* cause recurrent miscarriages in women?	503 (51.5%)	194 (19.9%)	278 (28.5%)
Does *Toxoplasmosis* cause infertility in women?	454 (46.5%)	221 (22.6%)	300 (30.7%)

3.3 Risk factors:

While more than half of students (530; 54.3%) reported that people can get *Toxoplasmosis* by changing cat litter, about a third (264; 27%)were unsure. About one third of participants was unsure about the role of meat either eating undercooked meat or handling meat as risk factor for *Toxoplasmosis*. Less than half of participants (395; 40.5%) thought that people can get *Toxoplasmosis* by eating undercooked meat. Slightly over half of the respondents (539; 55.2%) reported that people can get *Toxoplasmosis* by gardening without gloves but one third (249; 25.5%) of them was unsure. Less than one half of the participating students (420; 43%) knew that they could get *Toxoplasmosis* from unwashed fruits and vegetables (Table 3).

Table 3 *Risk factors*

Question	Yes	No	Not sure
Can people get *Toxoplasmosis* by changing cat litter?	530 (54.3%)	182 (18.6%)	264 (27%)
Can people get *Toxoplasmosis* by eating uncooked or undercooked meat?	395 (40.5%)	300 (30.7%)	281(28.8%)
Can people get *Toxoplasmosis* by handling raw venison (deer meat)?	186 (19.1%)	469 (48.1%)	321 (32.9%)
Can people get *Toxoplasmosis* by gardening without gloves?	539 (55.2%)	188 (19.3%)	249 (25.5%)
Can people get *Toxoplasmosis* by eating unwashed fruits and vegetables?	420 (43%)	282 (28.9%)	274 (28.1%)

3.4 Symptoms and timing of infection:

Females in the study were most knowledgeable about the fact that *Toxoplasmosis* in pregnant women (582; 59.6%) can lead to serious complications. At the same time, a high percentage of participating females (167; 17.1%) knew that *Toxoplasmosis* in a pregnant woman causes no symptoms. A significant percentage(535; 54.8%)of the participants also knew that unborn and/or newborn children develop serious complications after infection by *T. gondii*. However, a lofty percentage of females (385; 39.4%) were unsure about development of vision problems in babies infected with *Toxoplasmosis*. In addition, 336 participants (34.4%) were unsure about delivery of normal babies by women infected with *Toxoplasmosis* during pregnancy. Meanwhile, a high percentage of participants (430; 44.1%) were unsure that *Toxoplasmosis* in a pregnant woman cause swollen glands (lymph nodes). Half of the participating students (498; 51%) knew that a baby with *Toxoplasmosis* may be treated with medicine (Table 4).

Table 4 *Symptoms and timing of infection*

Question	Yes	No	Not sure
Can pregnant women develop serious complications after infection with *Toxoplasmosis* (*T. gondii*)?	582 (59.6%)	167 (17.1%)	227 (23.3%)
Can unborn and/or newborn children develop serious complications after infection with *Toxoplasmosis* (*T. gondii*)?	535 (54.8%)	189 (19.4%)	252 (25.8%)
Can *Toxoplasmosis* in a pregnant woman cause fever and feeling like you have the 'flu'?	498 (51%)	166 (17%)	312 (32%)
Can *Toxoplasmosis* in a pregnant woman cause swollen glands (lymph nodes)?	288 (29.5%)	258 (26.4%)	430 (44.1%)

Table 4 *Symptoms and timing of infection*

Question	Yes	No	Not sure
Can *Toxoplasmosis* in a pregnant woman cause no symptoms?	406 (41.6%)	300 (30.7%)	269 (27.6%)
Toxoplasmosis (*T. gondii*) can only be passed from a pregnant woman to her fetus if she is newly infected during that pregnancy.	431 (44.2%)	209 (21.4%)	336 (34.4%)
Toxoplasmosis (*T. gondii*) is rarely passed from a pregnant woman to her fetus if she was infected before becoming pregnant.	377 (38.6%)	233 (23.9%)	366 (37.5%)
A baby with *Toxoplasmosis* may have no signs of illness at birth, but develop illness later.	404 (41.4%)	216 (22.1%)	356 (36.5%)
A baby with *Toxoplasmosis* may have vision problems.	374 (38.3%)	215 (22%)	385 (39.4%)
A baby with *Toxoplasmosis* may be treated with medicine.	498 (51%)	169 (17.3%)	309 (31.7%)

3.5 Prevention knowledge:

One third of participants was unsure of ways to avoid *Toxoplasmosis* such as the type of cat food (289; 29.6%) and changing cat's litter box (245; 25.1%). In addition, some participating students were unsure that cooking meat well (339; 34.7%) and thoroughly washing and peeling fruits and vegetables before eating them (272; 27.9%) were also ways to avoid *Toxoplasmosis*. Finally, some participant was unsure that cleaning all cutting boards thoroughly after each use (302; 30.9%) may prevent *Toxoplasmosis* (Table 5).

Table 5 *Prevention knowledge*

Question	Yes	No	Not sure
Ways to avoid *Toxoplasmosis* include: feeding your cat dry or commercial cat food and not letting it kill and eat rodents.	501 (51.3%)	186 (19.1%)	289 (29.6%)
Ways to avoid *Toxoplasmosis* include: avoiding stray cats.	557 (57.1%)	173 (17.7%)	245 (25.1%)
Ways to avoid *Toxoplasmosis* include: avoiding dealing with cat's feces and letting someone else change the cat's litter box.	595 (61%)	149 (15.3%)	232 (23.8%)
Ways to avoid *Toxoplasmosis* include: making sure the cat's litter box is changed daily.	570 (58.4%)	169 (17.3%)	236 (24.2%)
Toxoplasmosis can be prevented by cooking meat well until no pink is seen and the juices run clear.	434 (44.5%)	203 (20.8%)	339 (34.7%)
Toxoplasmosis can be prevented by thoroughly washing and/or peeling all fruits and vegetables before eating them.	508 (52%)	196 (20.1%)	272 (27.9%)
Toxoplasmosis may be prevented by cleaning all cutting boards and utensils thoroughly after each use.	507 (51.9%)	166 (17%)	302 (30.9%)

3.6 Preventive behaviors:

High percentages of participants reported that they always wash their hands after gardening (705; 72.2%), changing cat litter (671; 68.8%) and after handling raw meat (626; 64.1%). Some participants engaged in high risk practices such as eating raw meat (191; 19.6%), using traditional herbs (333; 34.1%) and (185; 19%) dry their own clothes on trees, wood or handrail (Table 6).

Table 6 *Preventive behavior*

Question	Yes	No	Not sure
Since becoming pregnant, do you routinely wash your hands after gardening?	705 (72.2%)	162 (16.6%)	109 (11.2%)
Since becoming pregnant, do you routinely wash your hands after changing cat litter?	671 (68.8%)	169 (17.3%)	136 (13.9%)
Since becoming pregnant, do you routinely wash your hands after handling raw meat?	626 (64.1%)	211 (21.6%)	139 (14.2%)

Table 6 *Preventive behavior*

Question	Yes	No	Not sure
Since becoming pregnant, do you eat rare meat?	191 (19.6%)	695 (71.2%)	90 (9.2%)
Since becoming pregnant, do you eat wild plants like Fennel, Chard leaf, Khervic plant, Alsnaraya?	333 (34.1%)	535 (54.8%)	108 (11.1%)
Do you dry your own clothes on trees, wood or handrail?	185 (19%)	688 (70.5%)	103 (10.6%)

4. Discussion:

Demographic results of this study showed that the study population was heterogeneous in terms of area of living. Almost half students owned pets (411; 42.1%) in their household, which further increases the diversity of our study. There was a lack of awareness and knowledge amongst our sample about the source of *Toxoplasmosis*, the probable subsistence of the causative agent in cat feces, contaminated water, raw or undercooked meats; and its association with miscarriage and/or infertility in women. A high percentage of the participating females (503; 51.5%) knew that *Toxoplasmosis* can cause miscarriage in pregnant women, however many thought wrongly that infection before marriage could have negative consequences on women after marriage. Previous studies have shown the significance of knowledge about the life cycle of *Toxoplasmosis* to advise women in order to minimize their risk of being infected during pregnancy (Kravetz & Federman, 2005a, 2005b). This is mainly important since the bulk of pregnant women are at higher risk of being infected through ingesting tissue cysts through eating undercooked meats than from contact with cats (Cook et al., 2000).

Knowledge related to risk factors of having toxoplasmosis was also low in our sample predominantly those related to eating undercooked meat, handling raw venison, and gardening without gloves which exposes women to contaminated soil. These risk factors were identified by Cook and colleagues (Cook et al., 2000). Our results on risk factors are similar with those in the US among pregnant women who also reported low awareness that undercooked meat is a risk factor for acquiring *Toxoplasmosis* (Jones et al., 2003). A study by Jones et al. (Jones et al., 2001) showed a lack of analysis or education on safe gardening provided for pregnant women in the US.

Our participants reported several proper practices and behaviors related to prevention of *Toxoplasmosis* including washing hands after gardening and changing cat litter. At the same time, they reported some poor practices such as managing and eating raw meat and eating traditional herbs.

Due to the asymptomatic nature of primary *Toxoplasmosis*, counseling of pregnant women is of paramount importance to reduce the risk of fetal infection. Effective counseling for prevention requires knowledge of the peril factors associated with the spread of the parasite (Kravetz & Federman, 2005a, 2005b). Dissemination of appropriate knowledge by healthcare professionals to prevent infection is necessary especially for those most vulnerable pregnant women(Di Mario et al., 2009; Jones et al., 2003; Kravetz & Federman, 2005a, 2005b). For example, it was found that health education was associated with a 63% decrease in *Toxoplasmosis* seroconversion in Belgium (Foulon, Naessens, & Derde, 1994). A Canadian study at prenatal clinics demonstrated that educating women about the risk factors of *Toxoplasmosis* by trained personnel resulted in an improvement of the preventive practices (Carter, Gelmon, Wells, & Toepell, 1989) and prevented serious pregnancy- related complications(Avelino et al., 2014; Flatt & Shetty, 2013). Severe congenital infections due to *Toxoplasmosis* usually occur in countries that do not provide prenatal educational prevention programs for congenital *Toxoplasmosis* (Hughes et al., 2000).

On the other hand, most of participants in this study indicated that *Toxoplasmosis* infection throughout pregnancy will have negative consequences on the fetus without showing clinical signs in pregnant women. Alternatively our findings underline a deficiency of knowledge about certain aspects including symptoms and timing of infection during pregnancy especially those related to fetal complications after infection and clinical symptoms in infected pregnant women. Moreover, participating females in our study showed lack of information about methods to prevent and avoid *Toxoplasmosis* especially practices related to changing cat litter box and cooking meats and washing fruits and vegetables.

When some key questions about knowledge and preventive practices of *Toxoplasmosis* were examined (Table 5), knowledge and preventive practices amplified with cat ownership and with living in cities. Johns et al.(Jones et al., 2003)previously reported that elevated level of education and older age of the US population were linked with an better knowledge about *Toxoplasmosis*. However, parity and stage of pregnancy did not influence knowledge.

A limitation in our study was the self-reported instrument used in data collection, which has increased recall bias (Patrick et al., 1994). The results of this study demonstrated that there is a lack of knowledge and insufficient preventive practices related to *Toxoplasmosis* among undergraduate female university students in An-Najah National University. Another limitation is that we used convenient sample which limits the generalization of the results of our study.

5. Conclusion

In conclusion, these findings emphasize the critical need for *Toxoplasmosis* awareness and preventive education in childbearing females. An effectual education and outreach program should wrap up important topics regarding risk factors and preventive measures of *Toxoplasmosis*. Colleges and universities could be excellent locations to contact and educate this target group about the impact of zoonotic diseases on feminine wellbeing, particularly *Toxoplasmosis.*

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المعرفة والممارسات الوقائية بين الطالبات حول مرض المقوسات

كلمات مفتاحية:
داء المقوسات
الإناث
المعرفه.
الممارسات الوقائيه

داء المقوسات هو مرض معد، حيواني المنشأ، ومنتشر ويسبب المرض عواقب صحية خطيرة عند الإناث. هناك ندرة في البيانات حول معرفة الأناث وتصورهن حول داء المقوسات في العالم العربي بشكل عام وفي فلسطين بشكل خاص. لذلك، كان الهدف من هذه الدراسة هو تقييم المعرفة والممارسات الوقائية بين الطالبات حول مرض المقوسات.

تم إجراء هذه الدراسة بشكل مقطعي وصفي حيث تم إختيارعينة مناسبة من الإناث من جامعة النجاح ، مدينة نابلس، فلسطين. كما تم إستخدام إستبيان تم نشره سابقا لتحقيق هدف الدراسة.

تم تجنيد ما مجموعه 976 من الطالبات في جامعة النجاح الوطنية الذين تتراوح أعمارهن بين 18-23 سنه. ما يقرب من نصف الطالبات (503، 51.5٪) أفادوا بأنهم لم يسمعوا أو يقرأو أي معلومات عن داء المقوسات، وحوالي (905، 92.7٪) لم يتم فحصهن لداء المقوسات. كان هناك نقص في الإدراك والتصور حول عوامل الخطر، والأعراض، وتوقيت العدوى، والمعرفة الوقائية والممارسات المتعلقة بداء المقوسات. ومع ذلك، كان هنالك ارتفاع في معدلات الممارسات الصحية بين الإناث بما في ذلك غسل اليدين بعد التعامل مع فضلات القطط، علاج اللحوم النيئة والبستنة.

وأظهرت دراستنا عدم كفاية المعرفة حول داء المقوسات بين الطالبات الجامعيات في فلسطين. وهناك حاجة إلى حملات توعية لتثقيف الإناث اللواتي في سن الإنجاب حول العواقب الصحية والممارسات الوقائية لتجنب الإصابة