

Comparative Study of Toxoplasmosis in Bedouin, Semi-
Bedouin Women and their children in Jericho District

By



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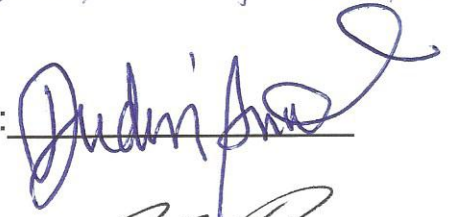
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Declaration

I certify that this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Abdul Muhsen Abu Fannouneh

29th of January 2005

Dedication

This work is dedicated to my deceased father who implanted the love of science and my illiterate mother who always encouraged and prepared for me a suitable place to study as possible. In addition, it is dedicated to my wonderful family, my lovely wife shatha, my beautiful daughters, Shirin, Dalia and Mohammad who always supported me continuously through the whole work of this study.

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Abstract

This comparative study aims to identify and evaluate factors that contribute to the spread of *Toxoplasma* infection among high risks Bedouin, semi-Bedouin women and their children (who were born between 01/01/2000 to 31/12/2003) in Jericho District. A non-probability purposive sample of 140 women (78 in the Bedouin group and 62 in the semi-Bedouin group) and 183 of their children (116 in the Bedouin group and 67 the semi-Bedouin group), was collected in the summer of 2004. The children of the Bedouin group included sixty-four (64) males and fifty-four (54) females while the children of the semi-Bedouin group included thirty-six (36) males and thirty-one (31) females. Blood was withdrawn from each mother and or her children, centrifuged and sera were stored at -18C. The sera were analyzed for Toxoplasmosis IgG using Micro-particle Enzyme Immunoassay (MEIA). The results showed that 56 of Bedouin women (71.8%) tested positive, 19 (24.3%) tested negative, and three (3.8%) fall in the greyzone. In comparison, the results for semi-Bedouin mothers showed that 22 women (35.5%) tested positive, 37 (59.7%) tested negative and three (4.8%) fall in the greyzone. Interestingly, in Bedouin group, one male and one female child born in the year 2000 tested positive while their mothers tested negative. Similarly, among semi-Bedouin group, one female child (born in the year 2000) and one female child (born in the year 2002) tested positive, while their mothers tested negative.

Concerning the factors that contribute to toxoplasmosis, the results showed a significant correlation between infection and feeding of cats on remnants of slaughter [$\chi^2 (2) = 25.3, p < .01$], planting vegetables and fruits near their houses [$\chi^2 (2) = 0.95, p < .01$], and un-washing vegetables and fruits before

eating [$\chi^2(4) = 15.95, p < .01$] in the Bedouin group. In comparison, a significant correlation is evident between Toxoplasmosis and age of mothers at first marriage [$\chi^2(6) = 17.059, p < .05$] and age of mothers at the time of the study and number of children of each age group [$\chi^2(10) = 36.4, p < .05$] in semi-Bedouin group. The results also showed a significant correlation between toxoplasmosis in children born in the year 2002 and feeding of cats on remnants of slaughter [$\chi^2(2) = 7.78, p < .01$], children born in the year 2001 and their place of residence [$\chi^2(16) = 32.7, p < .01$], play with cats [$\chi^2(12) = 26.27, p < .05$] and play with soil [$\chi^2(8) = 51.24, p < .05$], children born in the year 2000 and unwashing vegetables and fruits before eating them [$\chi^2(4) = 18.07, p < .01$].

These findings are consistent with previously known factors contributing to Toxoplasmosis; however, their effect on the Bedouin community is severe. Clearly, as the results showed, it is evident that changing life style in a positive way will exacerbate the spread of Toxoplasma infection among the population.

خلاصة البحث

تهدف هذه الدراسة إلى تبيان وتقييم العوامل المؤدية إلى العدوى بطفيل القطط (Toxoplasmosis) في الأمهات البدويات وشبه البدويات المعرضات للخطر وأطفالهن المولودين ما بين 2000/1/1 إلى 2003/12/31 في محافظة أريحا. لقد تم أخذ عينة غير عشوائية تتكون مما مجموعه 140 أم موزعة كما يلي: 78 أم بدوية, 62 أم شبه بدوية و183 طفل (116 طفل للأمهات البدويات و67 طفل للأمهات شبه البدويات). وكان في مجموعة الأمهات البدويات 64 طفل و54 طفلة وفي مجموعة الأمهات شبه البدويات 36 طفل و31 طفلة. في نفس الوقت جرى سحب عينات دم عددها 232 من الأمهات وأطفالهن في صيف عام 2004 وتم فصل عينات الدم وجرى تخزين الأمصال على درجة حرارة (-18م). بعد ذلك جرى فحص الأمصال للكشف عن وجود الأجسام المضادة (IgG) لطفيل القطط باستعمال طريقة (MEIA). بينت النتائج أن 56 أم بدوية (71,8%) موجبة الفحص, 19 (24,3%) سالبة الفحص وثلاث أمهات (3,8%) جاءت نتيجهن بالمنطقة الرمادية (لا موجبة ولا سالبة). بالمقارنة مع 22 أم شبه بدوية (35,5%) موجبة الفحص, 37 (59,7%) سالبة الفحص وثلاث أمهات (4,8%) جاءت نتيجهن بالمنطقة الرمادية. انه لمن الجدير ذكره أن طفل وطفلة مولودان في عام 2000 قد جاءت نتيجهما موجبة بينما أمهما نتيجهما سالبة في مجموعة الأمهات البدويات. وفي المقابل كان هناك طفل (مولود في عام 2000) وطفلة (مولودة في عام 2002) نتيجهما موجبة بينما أمهما نتيجهما سالبة في مجموعة الأمهات شبه البدويات.

فيما يتعلق بالعوامل المؤدية إلى حدوث العدوى الطفيلية, أشارت النتائج إلى وجود معامل ارتباط مهم ما بين حدوث العدوى وتغذية القطط على مخلفات الذبيحة [X2 (2) = 25.3, p < .01], وزراعة الخضروات والفواكه حول البيوت [X2 (2) = 0.95, p < .01] وعدم غسل الخضروات والفواكه قبل تناولها [X2 (4) = 15.95, p < .01] في مجموعة الأمهات البدويات. وبينت النتائج أيضا وجود معامل ارتباط مهم ما بين حدوث العدوى وعمر الأم عند الزواج [X2 (6) = 17.059, p < .05], وعمر الأم وقت إجراء الدراسة وعدد الأطفال المولودين في كل مجمعة عمرية [X2 (10) = 36.4, p < .05], في مجموعة الأمهات شبه البدويات. كما وأشارت الدراسة إلى وجود معامل ارتباط مهم ما بين حدوث العدوى وتغذية القطط على بقايا الذبيحة [X2 (2) = 7.78, p < .01] عند الأطفال المولودين عام 2002, مكان السكن [X2 (16) = 32.7, p < .01], اللعب مع القطط [X2 (12) = 26.27, p < .05] واللعب بالتراب [X2 (8) = 51.24, p < .05] عند الأطفال المولودين عام 2001. كما وبينت الدراسة وجود معامل ارتباط مهم ما بين حدوث العدوى وعدم غسل الخضروات والفواكه قبل تناولها [X2 (4) = 18.07, p < .01] عند الأطفال المولودين عام 2000.

نتائج هذه الدراسة تتوافق مع العوامل المؤدية إلى حدوث العدوى الطفيلية المعروفة عالميا, ولكن العدوى اشد في المجتمع البدوي. كما أن التغيير الايجابي لنمط الحياة في المجتمع سيؤدي إلى انتشار العدوى نتيجة لضعف المناعة والذي سينتج عن قلة الاحتكاك مع البيئة.

Chapter one

Literature review:

Literature review is done to identify those factors that contribute to the spread of Toxoplasmosis infection. The reviewed literature is composed of two parts:

(I) Theoretical review:

Toxoplasmosis is an infection caused by the single-celled parasite called *Toxoplasma gondii*. It is not a new disease, having first been discovered in 1908. Since its discovery, Toxoplasmosis has been found in virtually all warm-blooded animals including most pets, livestock and people. Nearly one-third of all adults in the U.S. and in Europe have antibodies in *Toxoplasma*, which means they have been exposed to the parasite (AVMA, 2003). Sheep, goats, deer and poultry are sources of meat commonly infected with *Toxoplasma*. *Toxoplasma* in meat can be killed by cooking at 152°F (66°C) or higher or freezing for a day in a household freezer (AVMA,2005). The parasite multiplies in the intestines of cats and is shed in cat feces, mainly into litter boxes and soil. Humans can get the parasite from handling cat litter or contaminated soil with cat feces. Alternatively, humans can get the parasite from eating uncooked or undercooked meat of infected animals such as cows, sheep, deer or poultry. In addition, the parasite can get into humans through eating unwashed fruits, vegetables, raw eggs, and drinking unpasteurized milk. Although many people in the community may have *Toxoplasma* infection, very few have symptoms because the immune system usually keeps the parasite from causing illness. Babies who become infected before birth can be born with serious mental or physical problems. If pregnant woman

contracts Toxoplasmosis, there is a 40% chance that her unborn child will become infected. Infection of adults is usually asymptomatic. However, Toxoplasmosis often causes flu-like symptoms, swollen lymph glands, or muscle aches and pains that last for few days to several weeks. Mothers can be tested to determine if they have developed an antibody to the parasite. Fetal testing may include ultrasound, and testing of amniotic fluid or cord blood for toxoplasma antibodies. The Public Health Service recommends that people who have been exposed to the toxoplasma parasite and who have less than 100 T4 cells take medications to prevent toxoplasmosis. The drug Bactrim can prevent toxoplasmosis and also is used to prevent PCP pneumonia. If you can't take Bactrim, the combination of dapson and pyrimethamine is recommended. Other drugs such as azithromycin (Zithromax), clarithromycin (Biaxin) and atovaquone (Mepron) may also work. On the other hand, severe fatal infections may occur in immunocompromised patients (AVMA, 2003, CERHR, 2002). The reason for severity or fatality is thought to be due to the reactivation of latent acquired infection that involves the central nervous system (CERHR, 2002). Transmission of the parasite through the placenta results in congenital toxoplasmosis that is thought to occur during the acute acquired maternal infection. The risk of fetal infection increases over time at which acute maternal infection occurs during pregnancy. Maternal infection contracted before conception presents little risk to the fetus. However, the incidence of congenital toxoplasmosis increases as pregnancy progresses. Moreover, the severity of congenital toxoplasmosis is greatest when maternal infection is contracted early during pregnancy.

A large number of infected infants in utero are asymptomatic at birth, especially if maternal infection occurs in the third trimester. Severe generalized or neurological disease occurs because of congenital toxoplasmosis. It is estimated in about 20-30% of the infected infants in utero; approximately 10% of these infants' exhibit ocular symptoms and the rest are asymptomatic. Sub-clinical infection may lead to premature delivery and subsequent neuralgic, intellectual, and audiological problems. Several studies showed that prenatal diagnosis of toxoplasma infection followed by prenatal therapy reduces the frequency and severity of the infection. Serologic tests can be used to identify those pregnancies at risk. Women, who are seronegative at the time of confirmation of pregnancy, can be monitored during pregnancy.

Pathogenesis in pregnancy is not fully understood however, most published data suggest a role of the genetic background of the host and of the parasite (Dupouy-Camet, 1979). Many trials have been done to evaluate Toxoplasmosis proteins such as P30 protein (SAG1) for manufacturing vaccines. The vaccine showed limited efficiency. A national survey in France showed that the prevalence of toxoplasma antibodies in plasma of pregnant women was 54.3% and the incidence was 1.5% of pregnant women (Dupouy-Camet, 1979).

Toxoplasma infection in pregnant women can be transmitted to fetus and cause severe illness such as blindness, mental retardation and epilepsy. It was estimated that about 400-4000 cases of toxoplasmosis occur in the USA. Fifty percent of the cases are believed to be attributed to eating contaminated meat. Toxoplasmosis is classified as the third leading cause of food borne

deaths in USA (CDC, 2000). There are 3 principal ways Toxoplasmosis is transmitted:

1. Ingestion of infectious oocysts from dirt in which cats have defecated or by ingestion of infective oocysts in food or water contaminated with feline feces.
2. Consumption of undercooked or raw meat from animals with tissue cysts.
3. Directly from pregnant mother to unborn child when the mother becomes infected with *Toxoplasma* during pregnancy (AVMA, 2003 and CDC, 2000).

Toxoplasmosis is found all over the world especially in cultures that favor consuming raw or undercooked meat. Pregnant women are at risk of acquiring toxoplasmosis from raw or undercooked meat or from contacting the soil without gloves. There are about 3000 cases of congenital toxoplasmosis in USA each year. Overall, outdoor cats pose more risk of toxoplasma infection than indoor cats (Yale Bulletin and Calendar, 2000).

A recent study concerning congenital toxoplasmosis in Israel, the authors reviewed the available data regarding the need for screening pregnant women or newborns for congenital toxoplasma infection in Israel (Miron, et al 2002). The authors concluded that until more epidemiologic data as well as results of cost-effectiveness studies are available, routine screening of pregnant mothers or newborns for toxoplasmosis is not justified.

(II) Study Review:

Three hundred and sixty-two apparently healthy Saudis of both sexes living in Riyadh and aged 4-60 years, were investigated for Toxoplasma antibodies using the indirect haemagglutination test (IHT). Eighty one (22.4%) were positive with titers of 1/64 or greater. A significantly higher prevalence of Toxoplasma antibodies was correlated with age and association with cats. Economic status showed an apparent, but not significant, negative correlation with antibody prevalence rates. No significant association was found between Toxoplasma infection and sex, consumption of raw or undercooked meat, and urban or rural residence. The results provide evidence that cats may be the main source of human infection with Toxoplasma in Riyadh (Ahmed M, 1992).

A group of 213 pregnant Jewish women of Israeli and from North-African/Asian origin in the Upper Gallilee in Israel was tested for Toxoplasma antibody, first at 4-12 weeks gestation and again 5-6 months later. Immunofluorescent antibody, Sabin-Feldman tests, and specific IgM estimation were used. The prevalence rates for seropositive women were lower in both groups (total 21%) than the rate found in a 1973 study in Israel. The incidence rate for infection acquired in pregnancy was 1.4%. There were no cases of congenital toxoplasmosis, as far as is known up to 3 years of age. More information on the prevalence and incidence of seropositivity, and on congenital toxoplasmosis, is required before a policy decision can be taken as to whether an antenatal screening program for toxoplasmosis should be instituted in Israel (Franklin, et al 1993).

Sera from 1,315 inhabitants of the Tel-Mond area were tested by the indirect Immunofluorescent and Sabin Feldman tests for Toxoplasma antibodies. The

overall prevalence of antibodies was 29.3%. Antibodies rose with age from 9.9% in the 1-4 year age-group up to 40.9% in the 45 age-group. There was no significant difference in prevalence of antibodies between the sexes. The prevalence of antibodies to *Toxoplasma* was lower in those born in Israel (21.2%) than in immigrants from Europe, America, Australia (49.4%), and Africa, Asia (40.8%) in the age groups of 20-45+. An extremely high prevalence of antibodies (41.5%) was found in Moshav Porat, a low socioeconomic settlement (Nishri, Z et al 1993).

The prevalence of antibodies against *Toxoplasma gondii* was measured in two rural populations in northern Israel-Jewish kibbutz members and Arab villagers. The respective prevalence in these two populations were 22.2% and 55.8% ($P < 0.001$). No correlation was found between the presence of antibodies and sex, occupation, contact with cats, a history of fever and/or lymphadenopathy, eye disease, abortions or delivery of children with congenital malformations. In contrast to Jewish children who were not found to have antibodies in the first decade of life, 20.5% of Arab children tested positive. A gradual increase in the prevalence of antibodies with age was seen in both groups, with the Jews reaching a prevalence of 42.6% at age 60+ and the Arabs reaching 74% at age 40. The difference between the two groups probably stems from different eating habits, namely ingestion of raw meat and unpasteurized milk and milk products (Raz, R et al 1993).

The profile of toxoplasmosis was studied among the inhabitants of two different localities in Dakahlia in relation to age, sex, occupation and contact with animals and/or birds. The total percentage of seropositive *Toxoplasma*

antibodies using Dot-ELISA was 23.8%. The seropositivity rate was higher among the inhabitants of the village particularly in those in contact with farm animals (Youssef, ME, 1993). A preliminary study was done at Makassed Hospital (between April-July, 1990), to evaluate the prevalence of toxoplasmosis among mothers and incidence of congenital toxoplasmosis among their infants (weight > 500gm). Cord blood samples from 1000 infants were tested using ELISA method. Those infants who were tested positive for IgG, their mothers blood were tested also for IgM. A total of 987 infants were included in this study. Results showed that 492 (49%) cord blood samples were tested positive, none of their mothers were tested positive for IgM, and no single case of congenital toxoplasmosis was reported. There was a significant difference between seropositive and seronegative mothers in regard to consumption of undercooked meat (Zughayar and Dudin, 1994).

Nine-hundred and ninety-six sera from women between the ages of 17-45 years were examined for *Toxoplasma gondii*; IgG and IgM antibodies by solid-phase-enzyme immunoassay. The overall prevalence of toxoplasmosis was found to be 39.9%. Of 996 women, 396 (39.6%) had specific IgG, 26 (2.6%) had both IgG and IgM, and 3 (0.3%) had only IgM antibodies. The results obtained in this study & other previous studies done in Turkey indicated the high prevalence of *Toxoplasma gondii* infection in Turkey (Durmaz R. et al 1995).

A survey was done to identify the etiology of hearing impairment among Saudi children that included 1054 subjects (aged 12 months to 14 years) who were chosen and divided into two groups according to the presence or absence of laboratory evidence of toxoplasmosis. The results showed that 70 children

(6.6%) tested positive IgM antibody against *Toxoplasmosis gondii* and 49 of the seventy infected children, (70%) were found to have bilateral senso-neural hearing loss (Al-Muhaimeed, 1996). Anti-Toxoplasma antibodies were determined with (IFA) Immuno-Fluorescent Assay) and ELISA tests in 9410 patients who were having different age groups and attended the Department of Parasitology from 1991 to 1995. Anti-Toxoplasma IgG antibodies were found positive in 4651 (49.4%) of these patients. 2287 (21.4%) patients were pregnant women and the positivity was 55% of them. According to history of these patients, seropositivity was found 50% in women having spontaneous abortion, 52% in women having stillbirth, in 55% women having abnormal fetal births. These patients and their culinary habits, the presence of cats and relationship with other clinical symptoms were also evaluated (Altintas et al 1997). A toxoplasmosis seroepidemiological survey was conducted on 13,018 sera samples collected by stratified cluster random sampling method from 12 provinces in Iran. The samples were studied by indirect Immuno-Fluorescent assay (IFA) for the presence of *Toxoplasma*. In this study, 52.6% of the subjects were male and the remaining 47.4% were female. Anti-Toxoplasma antibody was detected in 51.8% of the samples with no significant difference between male and female affected subjects. The distribution of the infected samples was also investigated in various age groups, the level of infection to *Toxoplasma* increasing from childhood, culminating to 30 years of age and gradually declining from there after. Between the various age groups, the 10-19 years old demonstrated a 50% increase in relative risk to the infection with high antibody titer. Within the provinces under study, the highest relative frequency of *Toxoplasma* antibody titer was indicated in Mazandaran province

(20.5%), while the lowest frequency was detected in Hormozgan (2.9%). In general, there was a decrease in the number of infected samples from humid areas in north to dry provinces in south of Iran. In the clinical symptoms study, no significant difference between male and female patients was demonstrated. According to the type of clinical manifestation, lymphadenopathy and central nervous system symptoms (encephalitis) were respectively the most and the least frequent manifestations. (Assmar M. et al 1997).

An investigation that was carried out to study the outbreak of toxoplasmosis association with municipal drinking water due to sudden increase in serological diagnosed cases of acute toxoplasmosis in one of the provinces of British Columbia, Canada. A screening program was initiated on 3812 women to identify those who were or had been pregnant. Hundred women met the criteria of being serologically and clinically positive. Nineteen of the cases had retinitis, 51 acquired lymphadenopathies, four cases had symptoms consistent with toxoplasmosis, seven cases possessed other symptoms, 18 cases were symptom free and one would not provide full information. The investigators concluded that the outbreak of toxoplasmosis is most likely because residents use unfiltered, un-chlorinated surface water (Bowie, et al, 1997).

In a study of paired maternal/ cord blood sample of 1503 women that were tested at the time of delivery for anti-toxoplasma IgG or IgM antibodies for one year. The results showed that 22.9% of women were IgG seropositive and 47 cases were positive for IgM, indicating a gestational toxoplasmosis incidence rate of 31/1000. Cord blood IgG seropositive was similar to that of the

maternal rate. Therefore, the rate of transplacental transmission was 38.3% with a prevalence of congenital toxoplasmosis of 12/1000 live births. There was no significant statistical correlation between maternal Seroprevalence and such well-known risk factors as consumption of uncooked meat and milk, or proximity of cats and other animals (Dar, et al 1997).

A serological study was done on Maternal and neonatal prevalence of toxoplasma, cytomegalovirus (CMV) antibodies, and hepatitis-B antigen in an Egyptian rural area. The study involved randomly selected sample of 150 pregnant women and their 150 newborn infants. Sera were collected from mothers during the first antenatal visit and at the time of delivery, cord blood specimens were taken from their infants to be tested for toxoplasma-IgG and IgM antibodies. The results showed that 64 pregnant women (43%) were immune at their first antenatal visit and their newborns were toxoplasma IgG positive. Toxoplasma specific IgM antibody was detected in only three mothers (2%) at the time of delivery. The rate of maternal infection in susceptible pregnancies was 4% and the maternal-fetal transmission rate was estimated to be 33%, since only one newborn infant tested positive for toxoplasma-IgM antibody at birth. This denoted that the prevalence of congenital toxoplasma infection $\leq 1.0\%$ to non-immune mothers. Furthermore, it was concluded that the prevalence of Toxoplasmosis during pregnancy and its trans-placental transmission rate in the rural Egyptian area are high compared to other countries in the area (El-Nawawy, A. et al, 1997).

Toxoplasma antibodies were detected in sera of 700 cases; 500 were collected randomly from individuals attending the outpatient clinics of Benha University Hospitals of different ages and sexes and 200 from suspected

inpatients from Obstetric, Ophthalmology, Internal Medicine and Surgery Departments. The indirect fluorescent antibody technique was performed. The results were correlated with the clinical picture, age, sex and residence. The general positivity rate was 14.57% in the random group, 11.2% and in suspected group, 23% ($P < 0.001$). Toxoplasma antibodies were more in females than in males in random group especially above 40 years old but with no obvious difference in rural and urban areas. In the suspected group, Toxoplasma positivity were 24% in Obstetric cases; 15% in hepatosplenomegalic cases, 17.5% in prolonged fever cases, 28.57% in ophthalmic cases and 40% in localized lymphadenopathy cases (Hamadto, HA et al 1997) .

In 1997, a study was done on 261 pregnant women who were screened by cordocentesis / or amniocentesis from 1987 to 1994. The following tests were used: (i) detection of anti-Toxoplasma gondii IgM, IgA, and IgE antibodies. and (ii) direct detection of the parasite in cell culture and mouse inoculation with FB and / or amniotic fluid (AF). Of the 31 cases of congenital toxoplasmosis, 24 (77%) were detected prenatally. Overall, the FB and AF inoculation methods were the most effective with 50% sensitivity to inoculation with FB and 74% with AF. Detection of antibodies in FB was the only positive test in these cases. Of the 18-surviving children diagnosed prenatally, only one child developed chorioretinitis at 9 months of age. Seven newborn (23%) with negative prenatal tests, were diagnosed by postnatal lab monitoring. Among those diagnosed children, one child developed clinical toxoplasmosis (Hezard, et al, 1997).

In 1998, Bobić et al investigated a group of 1157 female residents aged 15-45 years in a defined geographic area (Belgrade) over four years (1988-1991). They addressed the following in their investigation: Consumption of undercooked meat, contact with soil and cats, as well as residence, age, and education. Results showed that the rate of infection increases with age (mean 77%). However, it decreases significantly over the study time ($p = < 0.01$). The potential risk factors were examined using multiple regression and relative risk showed that Age got RR 1.18 with 95% CI, undercooked meat got (RR 2.22, $p = 0.001$) and the year of entry to the study (RR: 0.69, 95% CI). All were significantly associated with infection. However, the consumption of undercooked meat contributed to the frequency of the whole group, its significance increased with education and decreased with age. The infection was greater in suburb women, Moreover, women below 20 years who were exposed to soil showed significant association with infection (RR: 1.38, 95% CI: 1.12-1.97, $p = 0.037$).

Between 1992 and 1994, a screening program for detection of specific *Toxoplasmosis gondii* antibodies using 35,940 pregnant women was conducted in Norway. The ability of an antibody-screening program to detect infection occurring during pregnancy depends on not only on the diagnostic sensitivities and specificities of the tests used but also on compliance to the program (Jenum, p. et al, 1998).

A retrospective analysis to determine the status of toxoplasma (IgG & IgM) antibodies in United Arab Emirates (UAE) women with recurrent fetal loss was done using immunofluorescence assay. Two thousand three hundred and forty-three patients with one or more fetal loss were studied over a period of

five years. In patients with fetal loss, the range of toxoplasma IgG seropositivity varied from 24.2-30.6%. There were 3 patients with IgM positive. Only in a single patient, one of her two abortions could be attributed to acute toxoplasmosis. Habitual fetal loss cannot be attributed to chronic toxoplasmosis. In addition, 67.2% of the women of childbearing age group in U.A.E were found to be seronegative, highlighting the need for routine antenatal screening to detect primary acute toxoplasmosis (Singh N, 1998).

Svobodová and Literák (1998) studied the prevalence of IgM and IgG antibodies to *Toxoplasma gondii* in blood donors in Czech Republic. In their study on blood donors (n = 663) from the Noný Jičín district, for the presence of antibodies to *Toxoplasma gondii* using fluorescent antibody test to detect IgM and IgG antibodies, titers ≥ 20 were considered positive. The Seroprevalence of IgM and IgG antibodies was 2.4 % and 32.1%, respectively.

Review of 110 women files with toxoplasma seroconversion during pregnancy was done. Prenatal diagnosis was attempted for 94 women by amniotic fluid sampling. *Toxoplasma gondii* was detected by PCR with or without tissue culture and mouse inoculation. The early neonatal diagnosis procedure included placental testing by PCR and or mouse inoculation, cord blood serological testing, and comparison of maternal and newborn antibodies by Western blotting (WB). Congenital infection was diagnosed in 27 (20 live births) in the prenatal and or in the neonatal period. Placental examination was positive for 66.7% of individuals with congenital toxoplasmosis (CT) and was always negative for neonates without CT. Cord blood serology detected IgM and or IgA in 80% of infected newborns. WB detected bands on IgG and

IgM blots recognized by the newborn serum but not by maternal serum for 88.2% of infected infants within the first two months of life. Early postnatal diagnosis was negative for two of the 20 neonates with CT. Both of these newborns had a negative prenatal diagnosis and were asymptomatic (Robert-Gangneux et al, 1999).

Based on the study of Bowie, et al in 1997, another computer-generated dot mapping study was initiated by Stevens et al (1999) to investigate the outbreak of toxoplasmosis in the same province of British Columbia. Serologic screening was offered to an estimated 4500 who were pregnant between 1994-1995. The results confirmed the previous study finding that water is the source of the toxoplasmosis infection (Steven, et al 1999).

In a study done on 664 sera samples to evaluate Toxoplasmosis immunoglobulin (IgE) by using an immunocapture method, showed that IgE appears to be more useful in the course of biological monitoring than for diagnostic purposes (Villena, I. et al, 1999).

Wallon et al researched the evidence that treating toxoplasmosis in pregnancy reduces the risk of congenital toxoplasma infection and improves infant outcome. A systematic review of studies (n = 2591 papers) comparing at least two concurrent groups of pregnant women with proved or likely acute toxoplasma infection in which treatments were compared with no treatment and outcomes in the children were reported. Results showed that it was not clear whether antenatal treatment in women with presumed toxoplasmosis reduces congenital transmission of *Toxoplasma gondii*. It is concluded that screening programs are expensive, so the effects of treatment and impact of

screening need to be evaluated especially for those countries where screening programs are not done routinely (1999).

Flegr and others in 2000 studied the correlation of duration of latent *Toxoplasma gondii* infection with personality changes in women. The high rate changes were estimated by measuring the correlation between level of *Toxoplasma* antibody titers and personality factors in an experimental set of 55 young mothers (18-39 years old) with latent toxoplasmosis who were serologically tested positive for anti-toxoplasma antibodies, and other set of uninfected control group of the same age. Results suggested that the parasite induced the changes in personality profiles of latent infected women over time compared to the control group.

Punda-Polić and others (2000) studied the prevalence of IgG antibodies reactive with *Toxoplasma gondii* in the female population of the County of Split Dalmatia. A sample of 1109 serum collected from those females. A 38.1% of the sera reacted with *Toxoplasmosis gondii*. The frequency of positive sera increased with age. The estimated theoretical incidence of congenital *Toxoplasmosis* was 1.4 / 100 pregnancies of adolescents (16-20 years) and decreased to 0.1% in seronegative pregnant women aged (41-45 years).

In 2001, a cohort study was done to determine the methods used to diagnose congenital toxoplasmosis. One hundred sixty-five pregnant women infected during pregnancy over a 10-year period. Fifty-seven cases of congenital toxoplasmosis were identified (34.5%). Neonatal diagnosis gave positive results in 50 cases (88%). Parasites were isolated from placenta or cord blood in 61% of the infected newborns, more from placenta than cord blood, 60 %

and 43 % respectively. The detection of specific IgM and IgA antibodies in 42 sera of infected infants allowed the diagnosis of congenital infection in 34 cases (81%). Neonatal and prenatal screening was carried out for 143 pregnant women. When prenatal diagnosis is positive, pyrimethamine and sulfadoxine can be started in the first month of life. However, when the diagnosis is negative, neonatal screening combining parasite detection in placenta and anti-toxoplasma antibodies is essential.

This study aimed at studying seroprevalence of Toxoplasma IgG and IgM antibodies in sera from 5 areas in the Eastern Region of Saudi Arabia. A population based epidemiological approach, prevalence according to lifestyle (urban or rural), gender (male or female) occupation and age. Inactive toxoplasmosis (IgG levels) is of rather high prevalence in the human population in the Eastern Region of Saudi Arabia (25%). On the other hand, active toxoplasmosis (acquired during pregnancy) is of rather low prevalence in this study (5%). Active toxoplasmosis (IgM levels) is positively related to the level of exposure, high in farmers and employees in village rural areas and low in children and students in urban areas. Patients with active toxoplasmosis are to be treated and made aware of their situation. Hygienic conditions in areas of rather high prevalence of active toxoplasmosis are to be more strictly imposed to minimize transmission of the disease (Al-Qurashi, et al 2001). ELISA for toxoplasmosis was done on 152 randomly selected individuals, 31 full terms babies and 38 aborted or prematurely delivered women. Seropositivity to specific anti-toxoplasma IgG antibodies was observed in 57.9%, 58.1% and 44.7% of random, full term and aborted samples respectively. Only 10.5%, 6.5% and 23.7% were found seropositive

for specific anti-toxoplasma IgM, respectively. The risk of fetomaternal transmission was very high (50%). (Hussein, et al. 2001).

This study was done to determine the seroprevalence rate of *Toxoplasma gondii* in children of United Arab Emirates (UAE) main residential areas. Questionnaire information, clinical data and blood samples were obtained from 1006 primary school children residence of seven out of nine districts of UAE. ELISA was used for detection of antibodies against the immunodominant surface antigen (SAG1) of *Toxoplasma gondii*. The sensitivity and specificity of the employed ELISA were 98.4 and 99.1%, respectively using 'Eiken' latex agglutination test as a reference test. The Seroprevalence rates were remarkably variable in different residential areas and ranged between 3.5% for Dubai and 34.6% for Sharjah, with an overall prevalence of 12.5% for the seven districts. Rear of ruminants at home and consumption of raw milk associated significantly ($P < 0.05$) with exposure to *Toxoplasma gondii*. UAE children exposed to *Toxoplasma gondii* infection had a significantly higher hepatomegaly rate ($P < 0.05$) and complained more of various symptoms at the time of sampling ($P < 0.01$) compared to unexposed children. This study urges for more population studies to further identify the prevalence rates of toxoplasmosis in UAE in relation to age, gender, place of residence and risk factors (Abu-Zeid, YA 2002).

In 2002, Naoi and Yano, in their study on the theoretical analysis of the relations between the risk of congenital toxoplasmosis and the annual infection rate on Japanese young women. They quantitatively indicate a potential threat of congenital toxoplasmosis by using a simple mathematical

method or a special case of the well-known catalytic infection model. As the simulation indicated, Japanese young women are potential facing a threat of congenital toxoplasmosis, even though, the current risk of it is relatively low. This study indicated that a certain public intervention programs could prevent the risk of infection.

In a cross-sectional study to determine the Seroprevalence of Toxoplasmosis gondii agglutinins and the relationship between various risk factors and occurrence of toxoplasmosis in dogs in Trinidad, a total 250 dogs (domestic, hunting and stray) were studied. Results showed that 32% of the total tested positive at a titer $\geq 1:32$ using a latex agglutination test. Stray dogs (60.5%) had statistically significantly higher ($P < 0.001$) Seroprevalence for toxoplasmosis than hunting dogs (30.5%) and domestic dogs (25.5%). The prevalence of toxoplasmosis was significantly highest ($P = 0.037$) in dogs in the >2-3 years of age group compared with other age groups. The study also showed dogs that consumed homemade foods had a Seroprevalence of 32.9% compared with those fed commercially (17.2%) and dogs fed both homemade and commercial food (21%). (Ali et al, 2003).

A survey was conducted to study the prevalence of and risk factors for toxoplasma infection in 1997-1999 in Campos dos Goytacazaes, northern Rio de Janeiro State, Brazil. A total of 1436 serum samples were tested from three randomly selected categories (schools, communities, and army battalion). After adjusting for age, results showed that 84% of the population in the lower socioeconomic group was seropositive, compared with 62% and 23% of the middle and upper socioeconomic groups, respectively ($p < 0.001$). Multivariate analysis was also performed and showed that drinking unfiltered

water was found to increase the risk of seropositivity for the lower socioeconomic (odds ratio [OR]: 3.0, with 95% confidence interval (CI) 1.3-6.9 and middle socioeconomic (OR: 1.7, with 95% CI 1.2-2.3) population (Bahia-Oliveira et al, 2003).

Serum from 1400 human subjects of different age, occupation, life style of both sexes was collected. Serological analysis for inactive toxoplasmosis (levels of IgG) and active toxoplasmosis (IgM) was done using the Microparticle Enzyme Immuno-Assay (MEIA) IMx-Toxo, IgG and IgM assays. In Al-Nereiyah and Al-Qurain, the overall seroprevalence of inactive toxoplasmosis was almost similar (26.36% and 25.0% respectively), while active toxoplasmosis was higher in Al-Qurain (4.91%) than in Al-Nereiyah (3.78%). The seroprevalence of IgG was similar in males and females in both areas, but increased with age and was higher in housewives, employees and farmers than in students and children. Almost a similar result was recorded for IgM in respect to age and occupation except that seroprevalence was higher in females than in males in Al-Qurain area (Al-Qurashi, 2004).

Blood samples from 1149 pregnant women (age 26.9 +/- 5.3 years; mean 20 weeks gestation) on their first prenatal visit to Obstetrics and Gynecology Department and analyzed for Toxoplasma-specific immunoglobulin (IgM) and immunoglobulin (IgG) by ELISA. Six hundred and ninety-six (60.4%) of the women were IgG-positive, indicating previous maternal infection, while 35 (3%) were IgM-positive, indicating recent infection, and 420 (38.9%) were seronegative. The high seropositive rate may be linked to traditional raw meat consumption. Treatment with spiramycin was effective in preventing

congenital toxoplasmosis in children of seropositive mothers who consented to treatment (Harma M, et al 2004).

In summary, the following points could be lightened from reviewing literature.

- Neonatal screening both at placental and cord levels, is essential when prenatal diagnosis is negative. When diagnosis is positive, treatment with sulfamide and pyrimethamine should be started in the first month of life to prevent serious complications for pregnant women and her baby. (Bessières et al, 2001; Dar et al, 1997; Jenum et al, 1998; Robert-Gangneux et al, 1999; Wallon et al, 1999).
- Risk factors for toxoplasma infection include consumption of raw, undercooked or cured meat (lamb, beef, or game), direct contact with contaminated soil, contact with cats' litters, gardening and consumption of unwashed fruits and vegetables. Moreover, other risk factors include age of mothers, educational level and residence could pass toxoplasma infection to fetus through placenta in pregnant women (Bobić et al, 1998; CDC, 2003; Cook, 2000).
- Water (unfiltered and un-chlorinated) is likely to be the source of toxoplasma infection outbreak (Bahia-Oliveira et al, 2003; Bowie et al 1997; (CDC, 2003; Bowie, 1997).
- Stray dogs represent one mean of spreading toxoplasma infection (Ali et al, 2003).
- Toxoplasma infection produces hearing impairment among children (Muhaimed, 1996).
- Screening for toxoplasmosis is expensive; therefore, the effect of treatment and impact of screening programs should be evaluated.

Chapter Two

I The Problem:

This investigation was initiated to answer the following questions:

1) What is the percentage of Toxoplasma infection among Bedouin, semi-Bedouin women and their children in Jericho District?

2) Identify and evaluate the various factors that contribute to the spread of toxoplasma infection in the Bedouin community.

II Purpose of study:

The aim of this study is to identify and compare factors that contribute to the spread of Toxoplasmosis among high risks Bedouin, semi-Bedouin women and their children, who gave birth between 01/01/2000 to 31/12/2003 in Jericho District. The study plan includes two basic sections: (1) completion of specially designed questionnaire, and (2) Detection of IgG antibodies against toxoplasma gondii in the sera of collected blood samples from Bedouin, semi-Bedouin women and their children.

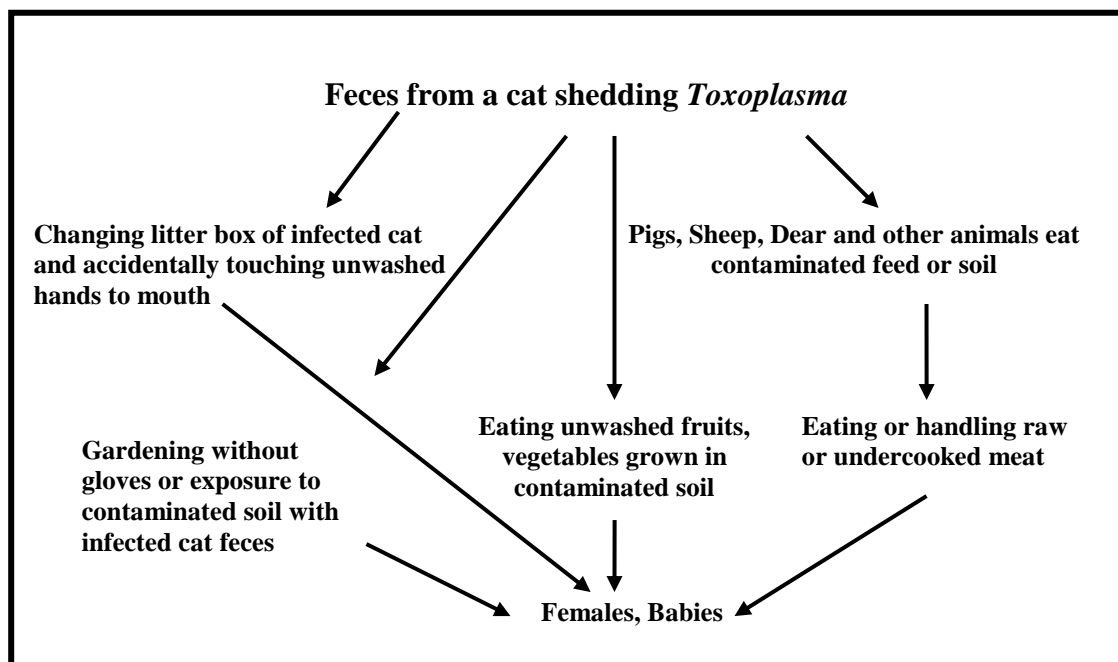
III Definition of tested population:

- Bedouin are nomadic people who share certain characteristics such as living in tents and travel across the country seeking grass for their cattle (The American Heritage Dictionary of the English Language, 1991).
- Semi-Bedouin: are people who share the same characteristics of Bedouin in their life style but live in simple housing units, raise cattle and cultivate some land.

IV Summary background:

The following framework of reference was used to support this study as summarized in the accompanying chart. Infected cats with toxoplasma protozoa, especially small ones, pass feces into the soil. Parasitic animals like sheep, dear, pigs and cows that eat grass from infected soil, the protozoa travels and hatch in their muscles. Eventually when Humans eat infected raw or undercooked meat, garden the soil without protection gloves, eat unwashed fruits or vegetables, or dispose infected cats litter without wearing gloves, can become infected with the parasite. Infection with toxoplasmosis poses great risk to pregnant women especially to their babies by passing the parasite to their fetus through the placenta leading to serious consequences such as mental retardation.

Toxoplasma Infection Chart



V Assumptions:

The following assumptions were made for the purpose of this study and were adopted from literature review:

1. Mothers will be truthful.
2. Cultural habits, values, beliefs and past exposure to toxoplasmosis may influence the study outcome.
3. Environmental factors such as living conditions, source of drinking water etc. will have an impact on the spread of toxoplasma infection.

VI Limitations of the study:

The results obtained in this investigation are governed by two fundamental criteria:

- 1) A non-probability, purposive sample is used instead of random sample. Including, about 70-80% of the assigned Bedouin and semi-Bedouin mothers that were investigated.
- 2) Some Bedouin families were unavailable at the time of the study because of their travel with cattle to mountains.
- 3) No demographic data is available on Bedouin community since the Palestinian Central Bureau of Statistics (PCBS) does not use this term.

VII Significance of the study:

Toxoplasmosis has negative impact on pregnant women as well as their infants and yet has been neglected by professionals as one of the possible cause of abortions in Palestine. This study will provide a database for further research in this field and alert professionals to fully study the scope of this infection and set standards of care in future.

Chapter Three

Methodology:

I **Design of the study:**

A comparative study is used to compare the factors that lead to the spread of Toxoplasmosis. The subjects included Bedouin, semi-Bedouin women and their children who were born between 01/01/2000 and 31/12/2003. A non-probability (purposive) sample of 140 women (78 in the case group and 62 in the control group) and 182 of their children (115 in the Bedouin group and 67 the semi-Bedouin group), was obtained respectively. The children of Bedouin group included sixty-five (65) males and fifty (50) females. The children of the semi-Bedouin group included thirty-eight (38) males and twenty-nine (29) females. The selection criteria for Bedouin group included:

- 1) Bedouin women must be pregnant at the time of the study or gave birth in the last three years.
- 2) All Bedouin mothers must be resident of Jericho District.
- 3) All Bedouin mothers must be living in tents.

The selection criteria for semi-Bedouin group included:

- 1) Semi-Bedouin women must be pregnant at the time of the study or gave birth in the last three years
- 2) All semi-Bedouin mothers must be resident of Jericho District.
- 3) All semi-Bedouin mothers must be living in basic housing unit made of bricks and roofed with asbestos.

II Setting:

Jericho District was the site of the study. The reasons for choosing Jericho:

-
- Jericho District represents the least developed and the most deprived District in the country.
- Lot of families who are either Bedouin or semi-Bedouin inhabits Jericho District.
- The life style of Bedouins and semi-Bedouin increases the risk of Toxoplasma infection.
- This study is funded through Alislah Charitable Society that is located in Jericho.

III Data collection:

. The process of data collection is comprised of two parts:

- 1) Questionnaire filling through household interview by the researcher
- 2) Blood samples collection and analysis. A well-trained laboratory technician collected 2-3 cc of whole blood, after obtaining consent of agreement from each subject. The questionnaire is composed of eighty-three questions and divided into five domains:

- Demographic data
- History of pregnancy
- Environmental risk factors
- Knowledge of the infection
- Children's Lifestyle

It took about 10 minutes to complete filling each questionnaire. Blood samples were collected in plain tubes from each subject and her child or

children who met the criteria. A total of 323 blood samples were collected. The blood is centrifuged and sera were stored in deep freeze at (-18C). The researcher transferred all sera in an icebox later to Medlab laboratory in Ramallah, for Toxoplasmosis IgG quantification using the AxSYM Toxo IgG assay (Abott Laboratory, USA). This assay is a Micro-particle Enzyme Immunoassay (MEIA) for the quantitative measurement of IgG antibodies to *Toxoplasma gondii* in human sera according the following protocol:

- Samples were stored at -18C and then mixed after thawing to insure consistency of results and centrifuged at $\geq 10,000 \times g$ for ten minutes before testing.
- The specimens were free of fibrin, red blood cells or other articulate matter.
- Heat treated specimens, lipemic, or grossly hemolyzed specimens, or specimens with obvious microbial contamination were eliminated.
- Specimens were marked using the age of each mother, and the age of the mother with the date of birth of each child.
- All samples were tested within three hours of being placed on-board by the AxSYM System.
- The sample volume required to perform a single Toxo IgG test on the AxSYM System is 150 μL and 33 μL for repeating the test from the same container.
- Each AxSYM Toxo IgG Assay Reagent pack is supplied with either a Master Calibration (2-point) or a Standard Calibration (6-point) procedure.

- The AxSYM Toxo IgG assay uses point to point data reduction to generate a standard calibration curve and the ratio A technique to generate an instrument specific Master calibration curve.
- Interpretation of AxSYM testing procedure:
 1. AxSYM Toxo IgG Antibody assay results of less than 2 IU/L are negative for IgG antibody to Toxo plasma gondii.
 2. AxSYM Toxo IgG Antibody assay results of greater than or equal to 3 IU/ml are positive for IgG antibody to Toxoplasma gondii and indicate acute or past infection.
 3. AxSYM Toxo IgG Antibody assay results of equal to or greater than 2 IU/ml and less than 3IU/ml are Greyzone. Greyzone samples may contain low levels of IgG. A second sample should be obtained and tested.
- The sensitivity of the AxSYM Toxo IgG is 99.7% and the specificity is 99.1%.

The investigator visited once each of the seven Bedouin clusters with Alislah mobile health team over seven weeks. These clusters are spreading all over Jericho District. Meetings with mothers were done in the tent (Shig) or house of al-Mukhtar. A brief explanation of the objectives and procedure of the study was given by the investigator. Each mother was interviewed and the investigator filled each questionnaire after obtaining an oral agreement of participation in the study. About 95% of mothers participated in the study and 5% refused. All the 95% of mothers answered the questionnaire and agreed to collect blood samples from them and their children. According to the lab

technician who is a Bedouin, it is estimated that about 70-80% of Bedouin and semi-Bedouin clusters have been visited.

IV Protection of human subjects:

Mothers were informed of the purpose and objectives of the study as well as blood withdrawal procedures. In addition, they were informed when they expect to get the result of the blood tests. Mothers were assured of anonymity and confidentiality. Furthermore, they were told that they might experience some pain and or repetition of blood sample re-withdrawal.

V Instrumentation: A self-developed questionnaire was used to collect the necessary information. The researcher could not get a standardized questionnaire. The questionnaire has eighty-three items and is divided into five domains. These domains are:

- 1) Demographic data
- 2) History of pregnancy
- 3) Environmental risk factors
- 4) Knowledge
- 5) Children's lifestyle.

It takes about 10 minutes to complete each questionnaire. The researcher filled himself the questionnaire of each mother.

VI Data Analysis: Results of blood analysis and questionnaires are analyzed using Statistical Package of Social Sciences (SPSS).

Chapter Four

Results:

I Demographic Data:

Figure (1) shows bar graph of age distribution of Bedouin mothers at the time of the study. The highest percentage was (35%) for women aged 22-26 years old followed by women (26%) aged 27-31 years old.

Figure (2) represent the age of mothers in the semi-Bedouin group that is comparable to the Bedouin group. About one-third of mothers aged 27-31 years (31%) while the least were aged 42-46 years (6%).

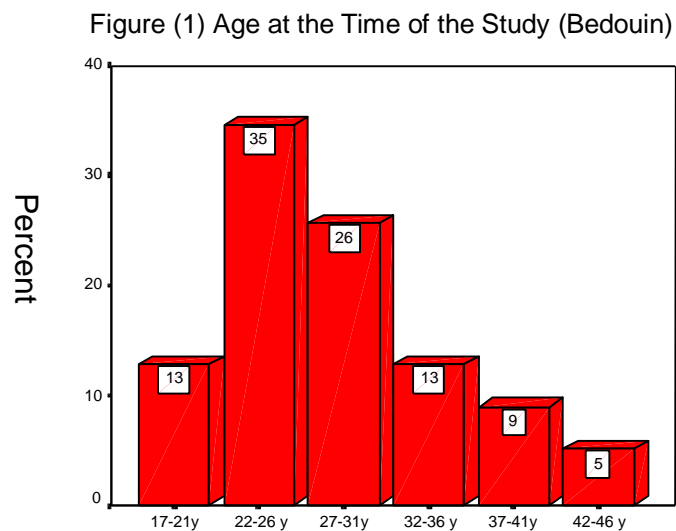
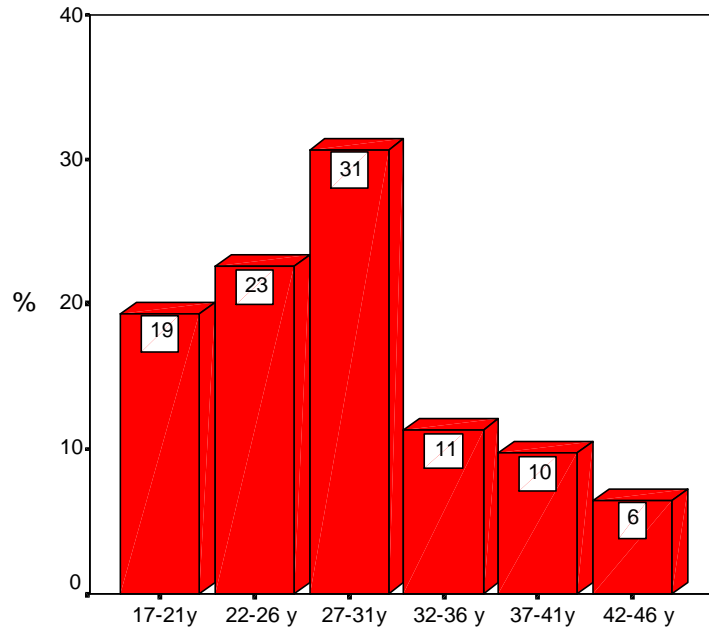


Figure (2) Age at the Time of the Study (Semi-Bedouin)



The total of subjects was 140 women and 183 children (78 Bedouin women and 115 children; 62 semi-Bedouin women and 68 children). Toxoplasmosis test results showed that 56 (71.8%) were tested positive, 19 (24.3 %) were tested negative, and three women (3.8%) were tested Greyzone, out of 78 Bedouin women (see table 1). Toxoplasmosis titer of Bedouin mothers, where the most frequent positive titer was 10 iu/ml of Toxo IgG (30 mothers) and the least frequent positive titer was 120 iu/ml of Toxo IgG (one mother).The mean titer was 11.5 iu/ml and a standard deviation of 1.5 iu/ml.

The toxoplasmosis testing result of total children born in 2003, 2002, 2001, and 2000, was as follows: 65 children males (5 males positive, 48 males negative and 5 males Greyzone).

The total number of children born in 2003 for total Bedouin mothers was 18 (10 male and 8 female children). Out of those 10 male children, one male was tested positive, 7 were tested negative and 2 were tested Greyzone. Out of

those 8 female children, 2 females were tested positive, 5 females were tested negative and one female was tested Greyzone. (IgG titer for positive children, was between 4 iu/ml to 8.1 iu/ml).

. The total number of children born in 2002 for Bedouin mothers was 37 (23 male and 14 female children). All of 23 males were tested negative. Out of those 14 female children, 12 females were tested negative and 2 females were tested Greyzone. The total number of children born for Bedouin mothers in 2001 was 33 (16 male and 17 female children). Out of those 16 male children, 2 males were tested positive, 13 males were tested negative and one tested Greyzone. Out of those 17 female children, 16 females were tested negative and one female was tested Greyzone. The total number of children born for Bedouin mothers in 2000 was 27 (16 male and 11 female children). Out of those 16 male children, 2 males were tested positive, 12 males were tested negative and 2 males were tested Greyzone. Out of those 11 female children, one female was tested positive and 10 females were tested negative (See table 1). The positive toxoplasmosis titer of children born on 2000 is between 59.5 – 188.56 iu/ml).

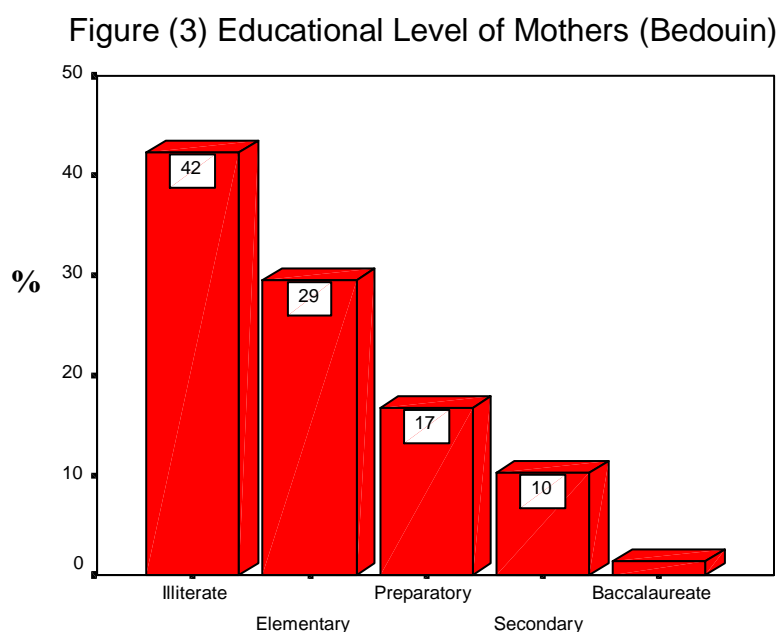
Total number of semi-Bedouin mothers tested was 62. Out of this number, 22 women (35.5%) were tested positive, 37 women (59.7%) were tested negative and three women (4.8%) were tested Greyzone. Total number of children born for semi-Bedouin mothers in 2003 was 12 (11 male and one female children). Out of those 11 male children, 10 were tested negative and one was tested Greyzone. The only female was tested positive. The total number of children born for semi-Bedouin mothers in 2002 was 19 (9 male and 10 female children). All 9 males were tested negative and out of those 10

females, 2 females were tested positive and 8 were tested negative. The total number of children born for semi-Bedouin mothers in 2001 was 21 (9 male and 12 female children). All 9 males were tested negative and out of those 12 females, one female was tested positive and 11 females were tested negative. The total number of children born for semi-Bedouin mothers in 2000 was 15 (9 male and 6 female children). Out of those 9 males, 8 males were tested negative and one male was tested Greyzone. Out of those 6 females, one female child was tested positive and 5 female children were tested negative (see table 1).

Table (1) Toxoplasmosis testing results of Bedouin and semi-Bedouin Mothers and Children

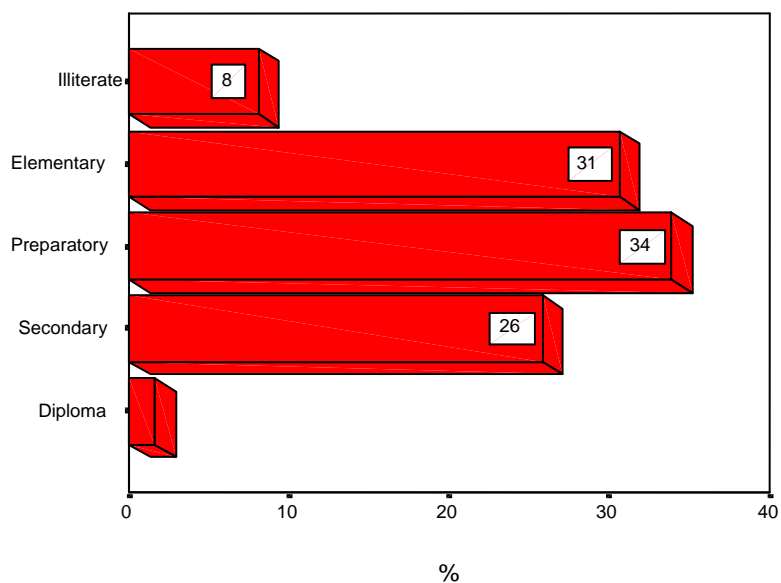
| Bedouin Group | Test Result | Mothers | Children 2003 | | | | Children 2002 | | | | Children 2001 | | | | Children 2000 | | | | Totals | | | | |
|------------------|---------------------------------------------------------|------------|---------------|----|-------|-------|---------------|-------|-------|-------|---------------|-------|-------|-------|---------------|-------|-------|-----|--------|------------|-----|----|--|
| | | | ♂ | | ♀ | | ♂ | | ♀ | | ♂ | | ♀ | | ♂ | | ♀ | | ♂ | | ♀ | | |
| | | | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | |
| | +tive | 56 | 1 | 5 | 2 | 5 | ---- | 17 | ----- | 12 | 1 | 12 | ---- | 11 | 1 | 7 | ----- | 9 | 3 | 41 | 2 | 37 | |
| | -tive | 19 | ----- | 2 | ----- | ----- | 6 | ----- | ----- | 1 | 1 | ----- | 5 | 1 | 5 | 1 | 1 | 2 | 14 | 1 | 6 | | |
| | Grey | 3 | 2 | | 1 | | ----- | | 2 | | 1 | | 1 | | 2 | | ----- | | 5 | | 4 | | |
| | Total Mothers | 78 | | | | | | | | | | | | | | | | | | | | | |
| | | | 1 | 7 | 2 | 5 | ---- | 23 | ----- | 12 | 2 | 13 | ---- | 16 | 2 | 12 | 1 | 10 | | | | | |
| | <i>Total Children</i> | | 10 | | 8 | | 23 | | 14 | | 16 | | 17 | | 16 | | 11 | | 65 | | 50 | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| Semi-Bedouin Gr. | +tive | 22 | ----- | 4 | ----- | ----- | 6 | 1 | 1 | ----- | 5 | 1 | 3 | ----- | 5 | ----- | 3 | 0.0 | 20 | 2 | 7 | | |
| | -tive | 37 | ----- | 6 | 1 | ----- | 3 | 1 | 7 | ----- | 4 | ----- | 8 | ----- | 3 | 1 | 2 | 1 | 16 | 3 | 17 | | |
| | Grey | 3 | 1 | | ----- | | ----- | | ----- | | ----- | | ----- | | 1 | | ----- | | 2 | | 0.0 | | |
| | Total Mothers | 62 | | | | | | | | | | | | | | | | | | | | | |
| | | | ----- | 10 | 1 | ----- | 9 | 2 | 8 | ----- | 9 | 1 | 11 | ----- | 8 | 1 | 5 | | | | | | |
| | <i>Total Children</i> | | 11 | | 1 | | 9 | | 10 | | 9 | | 12 | | 9 | | 6 | | 39 | | 29 | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | Mothers Grand total | 140 | | | | | | | | | | | | | | | | | | | | | |
| | Sub-grand total of Children | | 21 | | 9 | | 32 | | 24 | | 25 | | 29 | | 25 | | 17 | | 104 | | 79 | | |
| | Grand Total of Children both males & females | | | | | | | | | | | | | | | | | | | 183 | | | |

The educational level of Bedouin mothers was distributed as follows: Forty-two percent of mothers were illiterate. Twenty-nine percent of mothers' attained elementary classes, seventeen percent attained preparatory schooling, ten percent attained secondary schooling, and two percent attained baccalaureate schooling (see figure 3).



The educational level for semi-Bedouin mothers was distributed as follows: eight percent, 31%, 34%, 26%, and 1% were illiterate, elementary, preparatory, and secondary and diploma respectively (See figure 4).

Figure (4) Educational Level of Mothers (Semi-Bedouin)



Tables 2 and 3 show the distribution of Bedouin and semi-Bedouin mothers according to residence and number of visits to each residence.

Table (2) Distribution of Bedouin mothers according to residence

| | Khan Ahmar | Ein Eduk | Jericho | Oja | Faseil | Total |
|---------------------|------------|----------|---------|-----|--------|------------|
| Mothers | 14 | 9 | 4 | 31 | 20 | 78 |
| Children | 18 | 12 | 5 | 46 | 34 | 115 |
| No of visits | 2 | 1 | 1 | 2 | 1 | 7 |

Table (3) Distribution of semi-Bedouin mothers according to residence

| | Zbeidat | Marj Na'aja | Total |
|---------------------|---------|-------------|-----------|
| Mothers | 42 | 20 | 62 |
| Children | 43 | 25 | 68 |
| No of visits | 2 | 2 | 4 |

II History of pregnancy:

Regarding question seven about pregnancy, 21% of the Bedouin women reported that they are pregnant and seventy-nine percent reported that they are not pregnant. Forty-two percent of semi-Bedouin mothers reported that they are pregnant at the time of the study.

Table (4) shows weeks of pregnancy for both Bedouin and semi-Bedouin mothers at the three trimesters. For the Bedouin mothers, 79% were non-pregnant and 21% were pregnant (of those who were pregnant, 3% were pregnant in their first trimester, 9% were pregnant in their second and third trimesters respectively. For the semi-Bedouin mothers, 58% were not pregnant and 42% were pregnant (of those pregnant, 10%, 13% and 19% were pregnant in their first, second and third trimester respectively (See table 4).

Table (4) Distribution of pregnant & non-pregnant Mothers
(Bedouin and semi-Bedouin)

| | Pregnant | | | Non-pregnant |
|---------------------|-----------------|------------------|-----------------|---------------------|
| Bedouin | Yes (21%) | | | No (79%) |
| | First Trimester | Second Trimester | Third Trimester | |
| | 3 % | 9 % | 9 % | ----- |
| Semi-Bedouin | Yes (42%) | | | No (58%) |
| | 10 % | 13 % | 19 % | ----- |

Forty-one percent of Bedouin mothers aborted at least one time since they got married, while 59% of them did not abort at all since they got married. Forty-seven percent and 53% of semi-Bedouin mothers reported occurrence of abortion and no abortions since they got married. When women were asked

about if abortion occurred during Primigravida, 8% responded yes, and 42% said no and the other 50% did not respond.

Regarding abortion of Bedouin mothers during Primigravida, 14% and 23% of them reported that they aborted and not aborted respectively. Regarding abortion of semi-Bedouin mothers during Primigravida, 47 % and 53% of them responded that they aborted and not aborted respectively.

Regarding the cause of abortion, only 3% of Bedouin mothers responded that the cause of abortion was Toxoplasmosis. Ninety-five percent and 5 % of semi-Bedouin mothers reported that they did not know the cause of their abortion and know the cause of their abortion (Toxoplasmosis) respectively.

Regarding the number of stillbirths occurred for Bedouin women, 66 women (84.6%) reported that they did not have stillbirths at all, while six women (7.7%) reported that they had it once in their gestational history, three women (3.8%) had stillbirth more than one time and three women (3.8%) did not respond. About 8% of semi-Bedouin women (9 women) reported having one stillbirth during their gestational history, and about 92% (57 women) reported no history of stillbirth.

III Environmental risk factors:

(a) Meat consumption:

All Bedouin women (78) and semi-Bedouin (62) women reported that they consume meat. Regarding kind of meat consumed by families, 74 Bedouin families (94.9%) consume fresh meat only and four families (5.1%) consume both fresh and frozen meat. On the other hand, eight semi-Bedouin families

(12.9%) consume only fresh meat and 54 semi-Bedouin families (87.1%) consume both fresh and frozen meat.

Twenty-six Bedouin mothers (33.3%) reported that they have consumed raw meat and 56 of them (66.7%) reported that they never consumed raw meat. On the other hand, five semi-Bedouin mothers (8%) reported that they consume raw meat, and 57 mothers (92%) reported that they never consume raw meat. All Bedouin (78) and semi-Bedouin (62) families responded that they consume both internal organs and muscles of slaughtered animals.

Concerning what kind of raw internal organ consumed, 52 Bedouin mothers (67%) responded that they do not consume raw meat, 17 mothers (22%) reported consumption of raw liver, two mothers (2%) reported consumption of raw kidneys, and 7 mothers (9%) reported consumption of both raw liver and kidneys. On the other hand, three semi-Bedouin mothers (5%) reported consumption of raw liver, and one mother (2%) reported consumption of both liver and kidneys.

Forty-eight Bedouin mothers (61.5%) responded that they do hand-washing after processing raw meat, 28 mothers (36%) responded that they do so sometimes and two mothers (2.5%) responded that they do not wash their hands after processing raw meat. Compared to 57 semi-Bedouin mothers (92%) reported that they wash their hands after preparing raw meat for cooking, and 5 mothers (8%) reported that they wash their hands sometimes. All Bedouin mothers (100%) responded that they do not wear gloves if no hand washing is carried out. Compared to four semi-Bedouin mothers (6%), 55 mothers (89%) and three mothers (5%) reported that they wear, do not wear and sometimes wear agricultural gloves respectively.

Regarding washing utensils used to prepare raw meat, 19 Bedouin women (24%) responded that they sweep them only, 22 women (28%) responded that they clean them only with water, and 37 women (48%) responded that they clean them with soapy water. On the other side, 43 semi-Bedouin mothers (69%) reported that they wash utensils with soap and water, and 19 mothers (31%) reported that they wash utensils with water only (See table5).

Table (5) Washing utensils after preparing raw meat by Bedouin & Semi-Bedouin women

| | Sweep only | Clean with water only | Clean with soapy water |
|---------------------|-------------------|------------------------------|-------------------------------|
| Bedouin | 24 % | 28 % | 48 % |
| Semi-Bedouin | ----- | 31 % | 69 % |

Regarding the frequency of meat consumption by families per week, 20 Bedouin mothers (26%), 39 mothers (49%) and 19 mothers (25%) reported that their families consume meat once, twice and three times / week respectively. Regarding semi-Bedouin mothers, 31 mothers (50%) said that their families consume meat twice weekly, 23 mothers (37%) reported that their families consume meat once per week, and 8 mothers (13%) reported that their families consume meat three times weekly (See table 6).

Table (6) Consumption of meat / week by Bedouin & semi-Bedouin families

| | Once | Twice | Three times |
|---------------------|-------------|--------------|--------------------|
| Bedouin | 26 % | 49 % | 25 % |
| Semi-Bedouin | 37 % | 50 % | 13 % |

All Bedouin and semi-Bedouin women (100%) responded that their families like to consume well-cooked meat for at least sixty minutes. Furthermore, all

Bedouin and semi-Bedouin women (100%) reported that their families preferred to eat well-cooked meat.

Regarding cooking of meat, 73 Bedouin women (94%) reported that their families liked to eat both boiled and or grilled meat and only five mothers (6%) prefer to consume boiled meat. On the side, all the semi-Bedouin women (62) said that they like to eat both boiled and grilled meat.

(b) Raising cattle:

Seventy-seven Bedouin mothers (99%) responded that they raise cattle at home and one mother did not respond. Compared to 20 semi-Bedouin mothers (33%) and 42 mothers (67%) responded that they do raise, and do not raise cattle at home respectively.

Regarding what type of cattle raised, 38 Bedouin women (49%) responded that they raise sheep, 7 women (9%) lamb, 29 women (37%) both sheep and lamb. Compared to 20 semi-Bedouin women (32%) and 42 women (68%) responded that they raise, do not raise cattle respectively. (See table 7).

Table (7) Raising cattle by Bedouin and semi-Bedouin families

| | Raising cattle | | | | No (1%) |
|---------------------|----------------|------|------|-----------|-----------|
| | Yes (99%) | | | | |
| | Sheep | Lamb | Both | No answer | ----- |
| Bedouin | 49% | 13% | 37% | 1% | ----- |
| | Yes (33 %) | | | | No (67 %) |
| Semi-Bedouin | 21% | 6% | 5% | ----- | ----- |

Concerning cleaning of cattle yard, 71 Bedouin women (91%) and 7 women (8%) responded that men and both (men and women) clean the yard. Sixteen semi-Bedouin women (26%), 4 women (6%) and 42 women (68%) responded that men, women both (men and women) clean cattle yard respectively.

Regarding milking the cattle, 6 Bedouin mothers (8%), 22 mothers (28%), and 50 mothers (64%) responded that men, women and both (men and women) do milking respectively. Out of 77 Bedouin mothers who responded that they raise cattle, no men do diary processing while, 52 Bedouin women (67%), 25 women (32%) and only one woman (1%) responded that diary processing is done by women, both (men and women) and no response respectively. On the other hand, of the semi-Bedouin mothers who raise cattle (20 women), 6 women (10%), 9 women (15%), and 5 women (8%), responded that men, women and both (men and women) milk cattle respectively. Regarding diary processing, 6 semi-Bedouin mothers (32%) and 14 mothers (68%) of those who raise cattle (20 women), responded that men and women do diary processing respectively (See table 8).

Table (8) Milking cattle and diary processing by Bedouin and semi-Bedouin

| | | Men | Women | Both | No respond |
|---------------------|-------------------------|------------|--------------|-------------|-------------------|
| Bedouin | Milking cattle | 8 % | 28 % | 64 % | ----- |
| | Diary processing | None | 67 % | 32 % | 1 % |
| Semi-Bedouin | Milking cattle | 10% | 15% | 8% | ----- |
| | Diary processing | 32% | 68% | ----- | ----- |

(c) Raising cats:

Concerning raising cats, 57 Bedouin mothers (73%) and 21 women (27%) responded that they raise and do not raise cats near their tents respectively. In comparison, 49 semi-Bedouin women (79%) and 13 women (21%) raise and do not raise cats near their houses respectively (see table 9).

Table (9) Raising cats by Bedouin and semi-Bedouin

| Response | Yes | No |
|----------------------------|------|-----|
| Raising cats/ Bedouin | 73 % | 27% |
| Raising cats/ semi-Bedouin | 79% | 21% |

Regarding living place of cats, 53 Bedouin women (68%), 4 women (5%) and 21 women (27%) responded that cats live outdoor, indoor and did not respond respectively. Furthermore, 57 Bedouin women (73%) and 11 women (27%) responded that cats pass stool outdoor and indoor respectively.

In comparison, 38 semi-Bedouin women (61%), 21 women (34%) and three women (5%) responded that cats live outdoor, indoor and both (outdoor and indoor) respectively. Regarding passing stool, 48 semi-Bedouin women (77%) and one woman (2%) responded that cats pass stool outdoor, and both (indoor and outdoor) respectively (See table 10).

Table (10) Living and passing stool by cats / Bedouin & semi-Bedouin

| | | Indoor | Outdoor | Both | No response |
|---------------------------|------------------------|--------|---------|-------|-------------|
| Bedouin Group | Place of cat living | 5 % | 68 % | ----- | 27 % |
| | Place of passing stool | none | 73 % | ----- | 27 % |
| Semi-Bedouin Group | Place of cat living | 13% | 61% | 5% | 21% |
| | Place of passing stool | ----- | 77% | 2% | 21% |

Concerning feeding of cats on remnants of slaughter, 77 Bedouin women reported (98.7%) and 60 semi-Bedouin women (97%) responded that cats are fed on remnants of slaughter respectively.

(d) Planting soil:

Concerning planting of vegetables nearby their tents, 38 Bedouin mothers (49%), 23 women (29%) reported that they plant, do not plant vegetables around their tents respectively and 17 women (22%) did not respond. Of

those 38 women who reported planting vegetables, 13 women (33%) responded that they wash their hands after planting vegetables. Of those 23 women who responded that, they do not plant the soil, only one mother (4%) reported washing hands after planting vegetables. Seventy-five women (96%) reported that they do not put on gloves when planting the soil. Furthermore, 20 women (26%) reported that they wash their hands after contacting the soil (other than planting the soil), 32 women (41%) reported that they do not wash their hands when contacting the soil, and 66 women (33%) of mothers sometimes wash their hands when contacting the soil. Moreover, 54 women (69%) reported that they wash vegetable and fruits before eating them, 22 women (28%) responded that they sometimes wash vegetables and fruits, and two women (3%) said that they do not wash vegetable and fruits before eating them. (See table 11).

Table (11) Planting soil, washing hand, vegetables and fruits and wearing of gloves/ Bedouin

| | Yes | No | No respond | Sometimes |
|------------------------------------------|------------|-----------|-------------------|------------------|
| Planting soil | 49 % | 29 % | 22 % | ----- |
| Hand washing | 33 % | 4 % | ----- | ----- |
| Wearing gloves | 1 % | 96 % | 3 % | ----- |
| Hand Washing when contacting Soil | 26 % | 41 % | ----- | 33 % |
| Washing vegetables & fruits | 69 % | 3 % | ----- | 28 % |

Regarding planting vegetable near the house, 46 semi-Bedouin women (74%) reported that they plant some vegetables near their house and 16 women (26%) do not plant vegetable near their houses. Moreover, 36 women (58%), 14 women (23%) and 12 women (19%) reported that they wash their hands, do not wash their hands, and sometimes wash their hands after planting the soil respectively. Furthermore, 51 semi-Bedouin women reported (82%), 9

women (15%) and two women (3%) reported that women wear gloves, do not wear gloves, and sometimes wear gloves when contacting the soil respectively. Thirty-nine Semi-Bedouin women (63%), four women (6%) and 19 women (31%) reported that they wash, do not wash and sometimes wash vegetables and fruits before eating them (See table 12).

Table (12) Planting soil, washing hand, vegetables, fruits and wearing gloves / semi-Bedouin

| | Yes | No | No respond | Sometimes |
|------------------------------------------|------------|-----------|-------------------|------------------|
| Planting soil | 74% | 26% | ----- | ----- |
| Hand washing | 50% | 30% | 8% | 12% |
| Wearing gloves | 82% | 15% | ----- | 3% |
| Hand Washing when contacting Soil | 58% | 23% | ----- | 19% |
| Washing vegetables & fruits | 63% | 6% | ----- | 31% |

(e) Source of water:

Regarding source of water, 44 Bedouin women (56%), 28 women (36%) and six women (8%) responded that they use well water, spring water, and both (piped and well water) respectively. Moreover, all Bedouin women responded that they boil well and spring water. Nine Bedouin women (11%), six women (8%) and (81%) responded that they drink piped water; both (piped and spring water), and both (piped and well water) respectively.

In comparison, 14 semi-Bedouin women (23%), (42%) and (35%) responded that they boil, do not boil, sometimes boil water respectively.

IV Knowledge of mothers:

Concerning hear of Toxoplasmosis, 36 Bedouin mothers (46%), and 42 women (54%) reported that they heard about toxoplasmosis respectively. Five Bedouin women (6%) were known positive for toxoplasmosis and 73 women

(94%) do not know if they were tested before. Furthermore, 70 Bedouin women (90%) and eight women (10%) responded that they do not know and know some signs and symptoms of the disease respectively.

In contrast, hear of toxoplasmosis by semi-Bedouin women revealed the following: 44 semi-Bedouin women (71%), 11 women (18%) and seven women (11%) reported that they hear, did not hear about toxoplasmosis and did not respond respectively. Eleven women (18%) and 51 women (82%) responded that they undergone, did not undergo testing for Toxoplasmosis. Furthermore, all semi-Bedouin women (62) reported that no one of their children has undergone test for toxoplasmosis and no one of their family members has ever complained of toxoplasmosis. Regarding testing of children for Toxoplasmosis, 51 semi-Bedouin women (82%) and 11 women (18%) reported that they have been tested and not tested for toxoplasmosis respectively. None of the semi-Bedouin women, who were tested positive, reported that their children were tested too (See table 13).

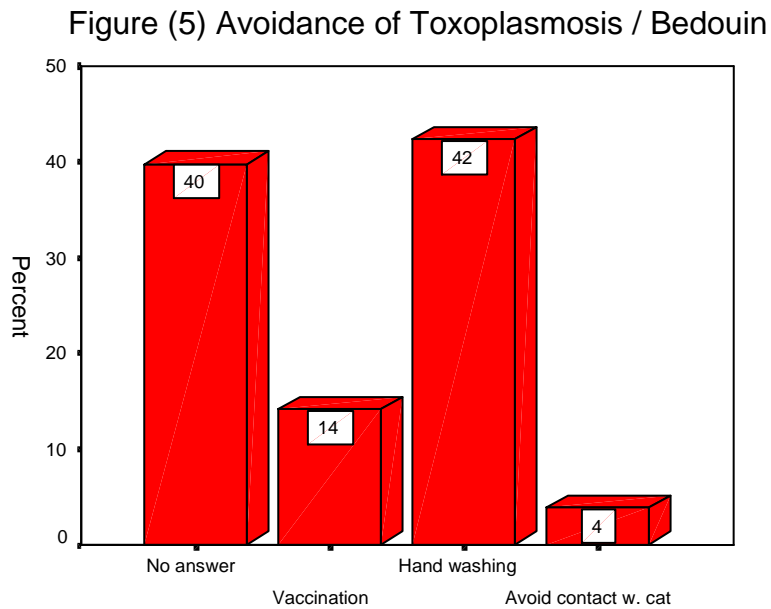
Table (13) Knowledge and result of Toxoplasmosis / Bedouin and semi-Bedouin

| | Awareness of Toxo | | Result of previous Toxo test | | Knowledge of signs & symptoms | |
|---------------------|-------------------|------|------------------------------|-------------|-------------------------------|------|
| | Yes | No | Positive | Do not know | Yes | No |
| Bedouin | 46 % | 54 % | 6 % | 96 % | 10 % | 90 % |
| Semi-Bedouin | 71 % | 29 % | 10 % | 90 % | 42 % | 58 % |

Regarding if any of the children of Bedouin mothers was tested if the mother was known positive, five mothers (6%) reported that their children were not tested, while 73 women (94%) said that they do not no if their babies were

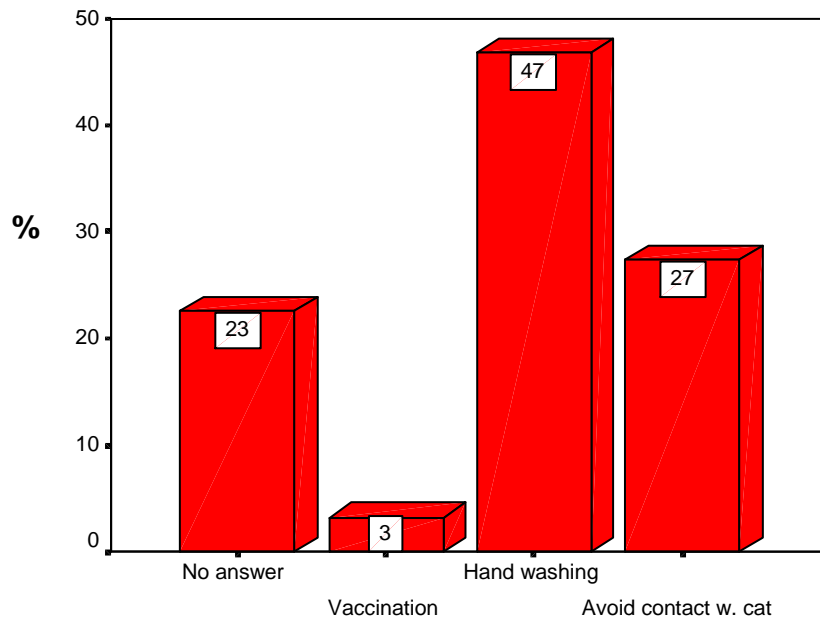
tested. Moreover, no single-family member of Bedouin mothers complained of signs and symptoms of toxoplasmosis.

Concerning avoidance of Toxoplasmosis, 31 Bedouin mothers (40%), 11 women (14%), 33 women (42%), and three women (4%) responded that they do not know, can be prevented through vaccination, prevented by hand washing, and prevented by avoiding contact with cats (See figure5).



Regarding avoidance of toxoplasmosis by semi-Bedouin mothers, 12 women (23%), two women (3%), 29 women (47%) and 17 women (27%) responded that they do not know, can be avoided by vaccination, hand washing, and avoiding contact with cats respectively (see figure 6).

Figure (6) Avoidance of Toxoplasmosis / Semi-Bedouin



Regarding testing for Toxoplasmosis, 50 Bedouin women (64%) and 28 women (36%) responded yes and no for Toxoplasmosis testing respectively. Furthermore, of those women (50) who responded yes for testing, 19 Bedouin (37%) did not respond, 18 women (36%) and 13 women (27%), responded prevention, and avoid complications respectively. Of those women (28) who responded no for testing, 18 Bedouin women (63%) did not respond, five women (19%), three women (10%) and two women (8%), responded, no need, expensive and testing needs to travel for long distance. Concerning semi-Bedouin women, 39 women (63%) and 23 women (37%) responded yes and no for Toxoplasmosis testing respectively. Of those semi-Bedouin women (39) who responded yes for Toxoplasmosis testing, reasons for yes: 25 women (63%) and four women (11%) responded prevention and avoid complications respectively and 10 women (24%) did not respond. Moreover, of those women (23) who responded no for Toxoplasmosis testing, reasons

for no: two women (8%), one woman (2%) and one woman (3%) responded no need, expensive and need long distance of travel respectively and 20 women (87%) did not respond. (See table 14).

Table (14) Yes and No for testing (Bedouin and semi-Bedouin)

| | Bedouin | | | Semi-Bedouin | | |
|---------------------|------------|---------------------|----------|--------------|------------------------------|-------------|
| | Yes (36%) | | No (64%) | Yes (63%) | | No (37%) |
| | Prevention | Avoid complications | No need | Expensive | Need long distance of travel | No response |
| Bedouin | 36 % | 27% | ----- | ----- | ----- | 37 % |
| | ----- | ----- | 19 % | 10 % | 8% | 63 % |
| Semi-Bedouin | 63% | 11% | ----- | ----- | ----- | 24% |
| | ----- | ----- | 8% | 2% | 3% | 87% |

Regarding treatment of Toxoplasmosis, 31 Bedouin women (40%), 38 women (49%) and nine women (11%) responded yes, no and did not response respectively. In contrast, 40 semi-Bedouin women (65%), 17 women (27%) and five women (8%) responded yes, there is treatment, no treatment and no respond respectively.

V Life style children:

Concerning sleep of cats with children, 11 Bedouin women (13%), 34 women (44%) and 33 women (43%) responded that cats sleep, do not sleep and sometimes sleep with their children respectively. Furthermore, 58 Bedouin women (74%), nine women (12%), seven women (9%) and four women (5%) responded that children play, do not play, play sometimes and did not respond respectively. Moreover, 48 Bedouin women (62%), 7 women (9%)

and 23 women (29%) reported that their children do not wash, and sometimes wash their hands after playing with cats respectively.

In contrast, seven semi-Bedouin women (11%), 45 women (73%) and 10 women (16%) reported that the cats sleep, do not sleep and sometimes sleep with their children respectively. Furthermore, 39 semi-Bedouin women (63%), 17 women (27%) and six women (10%) reported that their children play, do not play and sometimes play with cats respectively. Moreover, 12 semi-Bedouin women (20%), 17 women (27%) and 33 women (53%) reported that their children wash, do not wash and sometimes wash their hands after play with cats.

Regarding if the children play with soil, 69 Bedouin women (88%), three women (4%) and six women (8%) reported that of their children play, do not play and sometimes play with soil respectively. Furthermore, 35 women (45%) and 43 Bedouin women (55%) responded that they wash and do not wash hands of children after play with soil respectively.

Cross tabulation of variables:

I Cross-tabulation of Bedouin variables:

Table (15) Cross-tabulation of Bedouin variables

| Cross-tabulation / Bedouin | Chi-square |
|------------------------------------------------------------------------------------------|-------------------------------|
| Toxoplasmosis result of women and feeding of cats on remnants of slaughter. | [χ^2 (2) =25.3, p< .01] |
| Toxoplasmosis result of mothers and planting of vegetables and fruits near their houses. | [χ^2 (2) =0.95, p< .01] |

| | |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------|
| Toxoplasmosis result of women and un-washing vegetables and fruits before eating them. | [X ₂ (4)=15.95,p< .01] |
| Toxoplasmosis result of children born in the year 2001 and their place of residence | [X ₂ (16)=32.7,p< .01] |
| Toxoplasmosis result of children born in the year 2000 and washing of vegetables and fruits before eating them. | [X ₂ (4)=18.07,p< .01] |
| Toxoplasmosis result of children born in the year 2002 and feeding of cats on remnants of slaughter. | [X ₂ (2) = 7.78,p< .01] |
| Toxoplasmosis result of children born in the year 2001 and play of children with cats. | [X ₂ (12)=26.27,p<.05] |
| Toxoplasmosis result of children born in the year 2001 and play of children with soil. | [X ₂ (8)=51.24,p< .05] |

Table (16) Cross-tabulation of semi-Bedouin variables

| Cross-tabulation / semi-Bedouin | Chi-square |
|-------------------------------------------------------------------------------------------|------------------------------------|
| Age of mothers at the time of study and residence. | [X ₂ (5)=12.32,p< .05] |
| Age of control mothers at first marriage and Toxo result of control mothers. | [X ₂ (6)=17.059,p< .05] |
| Age of control mothers at the time of the study and number of children of each age group. | [X ₂ (10)=36.4,p < .05] |

The total number of the sample was 140 women (78 Bedouin and 62 semi-Bedouin) and 183 children (115 children in the cases and 68 children in the control groups).

The age group 17-21 years contains six mothers' positive and four negative.

Those six mothers who were positive compromise 10.5 % of the total mothers

who were positive. The second age group (22-26 years) revealed that 19 mothers were positive and eight negative. Those mothers who were positive compromise 33.3% of the total positive mothers. The third age group (27-31 years) revealed that 18 mothers were positive and two negative. Those mothers who were positive compromise 31.6% of the total mothers who were positive. The fourth age group (32-36 years) revealed that nine mothers were positive and one Greyzone. Those who were positive compromise 15.8% of the total positive mothers. The Greyzone mother (one mother) compromise 33.3% of the total Greyzone mothers. The fifth age group (37-41 years) revealed that three mothers were positive, three women negative, and one Greyzone. Those mothers who were positive compromise 5.3% of the total positive, while the Greyzone mother compromise 14.3% of the total mothers who were Greyzone. The sixth age group (42-46 years) reveals that two mothers were positive, one negative and one Greyzone. Those two mothers who were positive compromise 3.5% of the total positive mothers and the women that is Greyzone compromise 33.3% of the total Greyzone mothers. In summary, 56 mothers (73.8%) were positive, 19 mothers (23.4%) were negative and three (3.8%) were Greyzone.

Twenty-seven children (16 males and 11 females) were born for Bedouin women and 16 children for the semi-Bedouin women (9 males and 6 females) in the year 2000. One male child was positive that is (3.7%) and seven male children were negative (25.9 %). Moreover, one male child (3.7%) was negative while his mother was negative. Seven children (25.9%) were negative while their mothers were positive. No female child was positive and nine female children were negative in regards to their positive mothers.

Furthermore, one female child respectively was positive and negative in regards to their negative mothers. For the semi-Bedouin women (62), among the nine males, none was positive and five children were negative for the positive women (22). Among the negative women (37), no male child was positive and three male children were negative. Concerning the female children of semi-Bedouin mothers (62), no female child was positive and three female children were negative for the positive women. Among the negative control women (37), no male was positive and three male children were negative. No female child was positive and three female children were negative. Among the negative semi-Bedouin women (37), one female child was positive and two were negative.

The total number of children born in 2001 was 25. One child was positive, 22 children were negative, and one child had Greyzone result.

The total number of children who were born in the year 2002 is 30 children. All of them are seronegative for Toxoplasmosis. Out of the 15 children who were born in the year 2003, three children were identified positive, 8 children were negative and 3 children were identified as having grey result.

The Toxoplasmosis results of Bedouin mothers with their educational level, the following results appeared. Of those women who were positive, 22 women (38.6%) were illiterate; 20 women (35.1%) studied until the elementary level of schooling; seven women (12.3%) studied until the preparatory and secondary level of schooling respectively and one woman (1.8%) completed the baccalaureate level of schooling. Of those women who were tested negative, nine women were illiterate (50%); two women (11.1%) studied until the elementary level of schooling; six women (33.3%) studied till the preparatory

level of schooling and one woman (5.6%) studied till the secondary level of schooling. Among those women who were tested Greyzone, 2 women (66.7%) were illiterate and one woman (33.3%) studied until the elementary level of schooling.

Among the Bedouin women who were positive (56 woman), eight (14%) of them were pregnant and the rest were not pregnant (86%). Among the Bedouin women who were negative (18 woman), 7 women (38.9%) were pregnant and the rest were not pregnant. Among the Bedouin women who were having Greyzone (three women), one woman (33.3%) was pregnant and the rest (66.7%) were not pregnant.

Toxoplasmosis result of the mothers and weeks of pregnancy shows the following: Among Bedouin women who were tested positive for toxoplasmosis (56 women), 49 women (86%) were non-pregnant, one woman (1.8%) was pregnant in her first trimester, four women (7%) and three women (5.3%) were pregnant in their second and third trimesters respectively. Among those Bedouin women (19) who were tested negative; 11 (61.1%) were non-pregnant, one woman (5.6%) was pregnant in her first trimester, three and three women (16.7%) were pregnant in their second and third trimesters. Among those Bedouin, women who were tested Greyzone (3) for toxoplasmosis; two women were non-pregnant, and one woman was pregnant in her third trimester.

Positive toxoplasmosis result of Bedouin women (56) and occurrence of abortion showed that 21 (36.8%) and 36 (63.2%) women responded yes and no respectively to the question abortion. Among those Bedouin women who tested negative (19), nine (50%) and nine (50%) women responded yes and

no respectively to the question of abortion. Among those Bedouin, women who were tested Greyzone; two women (66.7%) and one woman (33.3%) responded yes and no to the question of abortion respectively.

Positive toxoplasmosis result of Bedouin women and frequency of abortion showed that; 36 women (63.2%) had no frequency of abortion, eight women (14%) aborted one, five women (8.8%) aborted twice, three women (5.3%) aborted three times, two women (3.5%) aborted four times, and one woman (1.8%) aborted five, seven and eight times respectively.

Positive toxoplasmosis result of Bedouin women (56) and occurrence of abortion during Primigravida showed that 37 (64.9%) women did not respond to this question, nine women (15.8%) responded yes and 11 women (19.3%) responded no to occurrence of abortion during Primigravida. Among those Bedouin women (19) who were tested negative, 11 (61.1%) did not respond to this question, two women (11.1%) and five women (27.8%) responded yes and no respectively to occurrence of abortion during Primigravida. See table below. Among those Bedouin, women (3) who were tested Greyzone, one (33.3%) woman did not respond and two women (66.7%) responded no respectively to occurrence of abortion during Primigravida.

Toxoplasmosis result of Bedouin women and cause of abortion, showed that among those (56) women who were tested positive, 55 women (96.5%) responded that they do not know the cause of their abortion and only two women (3.5%) responded that the cause of their abortion was toxoplasmosis. All Bedouin women (19) who were tested negative responded that they do not know the cause of their abortion. All Bedouin women (3) who were tested Greyzone did not know the cause of their abortion.

Toxoplasmosis result of Bedouin women and sequence of abortion showed the following: Among those Bedouin women (56) who were tested positive for toxoplasmosis, two women (3.5%) said that abortions occurred in sequence (one abortion followed by another). Nine women (15.8%) reported no sequence occurred in abortion and the majority of women (80.7%) said that they do not remember if abortions occurred in sequence. Among those Bedouin women who were tested negative (19). One woman (5.6%) responded yes that the abortion occurred in sequence; three women (16.7%) said that abortion did not occur in sequence, and the rest of women said that they do not remember. Among those Bedouin women who were tested Greyzone (3), one woman (33.3%) said yes that abortion occurred with her in sequence and the other two women (66.7%) said that they do not remember.

Toxoplasmosis result of Bedouin women and number of stillbirths showed the following: among the total Bedouin women (78), 56 women were tested positive, six women (10.5%) reported that they got stillbirth once, one woman (1.8%) reported having stillbirth twice, three and four times respectively and the majority of women (84.2%) reported having no stillbirths. Among those Bedouin women (19) who were tested negative, two women (11.1%) reported having stillbirth one time and the majority of women (88.9%) reported having no history of stillbirth. Among those women (3) who were tested Greyzone, one woman (33.3%) reported having one time stillbirth and the rest of women (66.7%) reported having no history of stillbirth.

Toxoplasmosis result of Bedouin women and kind of meat consumed by families showed the following: among those Bedouin women, who were tested

positive (56), the majority (93%) of families consumes fresh meat and the rest of families (7%) consume both fresh and frozen meat.

Toxoplasmosis result of Bedouin women and consumption of raw meat revealed the following: among those Bedouin, women (56) who were tested positive, 23 women (40.4%) responded yes to consumption of raw meat. Thirty-four women (59.6%) responded no to consumption of raw meat. Among those women (19) who were tested negative, three women responded yes to consumption of raw meat and 15 women responded no to consumption of raw meat. All women (3) who were tested Greyzone responded no to consumption of raw meat.

Toxoplasmosis result of Bedouin women and type of raw meat consumed showed that: Among those Bedouin women (56) who were tested positive 24 women (59.6%) did not respond, 16 women (28.1%) responded that they consume liver, two women (3.5%) responded that they consume kidneys and the rest of five women (8.8%) said that they consume both liver and kidneys. Among those Bedouin women (19) who were tested negative, 15 women (83.3%) did not respond, and the rest of the women responded that either they consumed kidneys and or liver. Regarding those Bedouin women (3) who were tested Greyzone, none of them responded to this question.

Toxoplasmosis result of the Bedouin women and hand washing after processing raw meat showed that: among those Bedouin women (56) who were tested positive, 37 women (64.9%) responded yes to hand washing, one woman (1.8%) responded no to hand washing and 19 women (33.3%) responded sometimes to hand washing. Among those Bedouin women (19) who were tested negative, nine women (50%) responded yes to hand

washing after processing raw meat, one woman (5.6%) responded no and eight women (44.4%) responded sometimes. Three Bedouin women who were tested Greyzone; two of them (66.7%) responded yes to hand washing and the other woman (33.3%) responded sometimes.

Toxoplasmosis result of Bedouin women and what is done with utensils used to prepare the raw meat showed the following: Among those Bedouin women (56), who were tested positive, 14 women (24.6%) responded that they sweep utensils only. Sixteen women (28.1%) said that they clean utensils by water only and 27 women (47.4%) responded that they wash utensils with soap and water. Among those Bedouin women (19) who were tested negative, five women (27.8%) responded that they sweep utensils only; four women (22.2%) said that they wash them with water only and nine women (50%) responded that they wash utensils with soap and water. Among those Bedouin women who were tested Greyzone (3), two women (66.7%) said that they wash utensils with water only and one woman responded that she washes utensils with soap and water.

Toxoplasmosis result of Bedouin women and frequency of meat consumption per week showed the following: among those Bedouin women (56) who were tested positive, 13 women (22.2%) responded that they consume meat once per week; 27 women (48.2%) said that they consume meat twice weekly and 16 women (28.6%) responded that they consume meat three times per week. Among those Bedouin women who were tested negative (19), five women (26.3%) said that they consume meat once per week, ten women (52.6%) responded that they consume meat twice per week and the rest (4) of women (21.1%) said that they consume meat three times / week. Among those

Bedouin, women who were tested Greyzone (3), two women (66, 7%) reported that they consume meat once per week and one woman (33.3%) responded that they consume meat twice per week.

Toxoplasmosis result of Bedouin women and method of cooking showed the following: most of the Bedouin women(56) who were tested positive (96.5%), and those Bedouin women who were tested negative (83.3%) and all women who were tested Greyzone (100%), like to eat meat both ways (boiled and roasted).

Toxoplasmosis result of Bedouin women and raising cattle showed the following: all those Bedouin women (56) who were tested positive, raise cattle at home. Almost all those Bedouin women (19) who were tested negative (94.4%) and all those Bedouin women (3) who were tested Greyzone raise cattle at home.

Toxoplasmosis result of Bedouin women and cleaning yard of cattle showed the following: among those Bedouin women who were tested positive (56), responded that men (91.2%) mainly carry out cleaning of cattle yard. Among those Bedouin women who were tested negative (19), responded that men (94.4%) mainly carry out cleaning of cattle yard and the rest of women did not respond. Among those Bedouin women who were tested Greyzone (3), two women (66.6%) responded that men do cleaning of cattle yard and the other woman said that both spouse clean the cattle yard.

Toxoplasmosis result of those Bedouin women and milking cattle showed the following: among those Bedouin women who were tested positive (56), both spouse (63.2%) milk the cattle, and 28.1% of milking is carried out by women. Among those Bedouin women who were tested negative (19), both spouse

(66.7%) do milking and women do 33.3% of milking. Regarding those women who were tested Greyzone (3), one woman in each category responded that woman, man and no respond does milking respectively.

Among those Bedouin women who were tested positive (56), mostly women (68.4%) process the milk products. Among those women who were tested negative (19), mainly women (66.7%) carry out-processing of diary product. Among those Bedouin women who were tested Greyzone (3), 66.7% of the milk processing is carried out by both spouses.

Among those Bedouin women who were tested positive (56), 26.3% said that they do not raise cats, while 50.9% responded that they raise one cat at home and 21.1% said that they raise two cats. Among those Bedouin women who were tested negative (19), 55.6% and 33.3% of women responded that they raise one cat and two cats respectively. Among those Bedouin women who were tested Greyzone (3), 33.3% and 66.7% responded that they raise one cat and two cats respectively.

Among those Bedouin women who were tested positive (56), 63.2% and 5.3% of mothers responded that cats live outdoor and indoor respectively. While 31.6% of Bedouin mothers responded that they do not raise cats at all. Among those women who were tested negative (19), 83.3% responded that cats live outdoor. Among those women who were tested Greyzone (3), 66.7% responded that cats live outdoor.

Among those Bedouin women who were tested positive (56), 68.4% of mothers responded that cats pass stool outside and the rest of mothers did not respond. Among those Bedouin women who were tested negative (19), 88.9% of mothers responded that cats pass stool outside and the rest did not

respond. Among those mothers who were tested Greyzone (3), 66.7% of mothers responded that their cats pass stool outside and the rest of mothers did not respond.

All Bedouin women who were tested positive (56) and those who were tested negative (19) responded that their cats are fed on remnants of slaughter. However, among those women who were tested Greyzone (3), 66.7% of mothers responded yes to feeding of their cats on remnants of slaughter. Chi-square test showed that there is a strong relation between positivity of Toxoplasmosis results of mothers and feeding of cats on remnants of slaughter [$\chi^2 (2) = 25.3, p < .01$].

Among those Bedouin women who were tested positive (56), 59.4% of respondents said that they plant vegetable and fruits in vicinity of their houses and the rest said that they do not plant anything near their houses. Among those Bedouin women who were tested negative (19), 72.2% responded that they plant vegetables and fruits around their houses and the rest said that they do not plant anything. Among those Bedouin women who were tested Greyzone (3), 66.7% of mothers said that they plant vegetables and fruits near their houses. Chi-square test showed that there is a relation between the Toxoplasmosis results of mothers and planting of vegetables and fruits near their houses [$\chi^2 (2) = 0.95, p, < .01$].

Among those Bedouin women who were tested positive (56), 54.4% of mothers did not respond to this question; 40.4% said yes to wash hands and 5.3% said that they do not wash hands after planting the soil. Among those Bedouin women who were, tested negative (19), 44.4% of respondents did not answer this question; 50.0% said yes to hand washing and 5.6% said no

to hand washing. Among those Bedouin women who were, tested Greyzone (3), 66.7% of mothers did not respond to this question and 33.3% responded yes to hand washing.

Among those Bedouin women who were tested positive (56), 26.3% responded that they wash their hands when contacting the soil; 40.4% said that they do not wash their hands when contacting the soil and 33.3% said that they sometime wash their hands. Among those Bedouin, women who were tested negative (19), 27.8% of mothers responded yes and sometimes respectively to hand washing. Among those Bedouin women who were tested Greyzone (3), 33.3% said that they do not wash their hands and 66.7% they some time wash their hands when contacting the soil.

Among those Bedouin women who were tested positive (56), 1.8% of mothers said yes to wearing gloves when planting the soil, 94.7% responded no to wearing gloves and the rest of mothers did not respond. Among those Bedouin mothers who were tested negative (19), all of them responded no to wearing gloves. Among those Bedouin, women who were tested Greyzone (3), all of them responded no to wearing gloves.

Among those Bedouin women who were tested positive (56), the majority (73.7%) said that they do wash vegetables and fruits before easting them, 24.6% responded that they do sometimes wash vegetable and fruits before eating them and the rest 1.8% do not wash them. Among those Bedouin women who were tested negative (19), the majority (66.7%) responded that they do wash vegetables and fruits before eating them and 33.3% said that they do sometime wash vegetables and fruits before eating them. Among those Bedouin women who were tested Greyzone (3), 66.7% of mothers

responded that they sometime wash vegetables and fruits before eating them, while the other one-third (33.3%) do not wash them before eating them. Chi-square test showed that there is a strong relation between the positivity of Toxoplasmosis results of mothers and un-washing vegetables and fruits before eating them [$\chi^2 (4) = 15.95, p < .01$].

Among those Bedouin women who were tested positive (56), 91.2% responded that they have, never undergone lab test for toxoplasmosis and only 8.8% responded yes for being tested for toxoplasmosis. Among those Bedouin women who were tested negative (19), all women responded that they have never being tested for toxoplasmosis. Among those Bedouin, women who were tested Greyzone (3), all of mothers said that they never being tested for toxoplasmosis.

Most of Bedouin women (91.2%) responded that they do not know and the (8.8%) of Bedouin women responded that no testing was done for their children. Among those Bedouin women who were tested negative (19), all of them responded that they do not know if their children were tested for toxoplasmosis. Among those Bedouin women who were tested Greyzone (3), all of women responded that they do not know if their children have been tested for toxoplasmosis.

Among those Bedouin women who were tested positive (56), 42.1% responded that they do not know the answer, 12.3% of them said that Toxoplasmosis can be avoided by vaccination, 40.4% by hand washing, 5.3% by avoiding contact with cats. Among those women who were tested negative (19), 33.3%, 22.2%, 44.4% of Bedouin women responded that no answer, vaccination, and hand washing respectively. Among those Bedouin women

who were tested Greyzone (3), 33.3% and 66.7% responded respectively that they do not know the answer and toxoplasmosis can be avoided by hand washing.

Among those Bedouin women who were tested positive (56), the majority of mothers (56.1%) said that they obtain water for drinking from wells, 35.1% from springs and 8.8% from pipes and wells. Among those Bedouin women who were tested negative (19), the majority of mothers said that they obtain drinking water from wells, 27.8% from springs and 5.6% from both pipes and wells. Among those women who were, tested Greyzone (3), all of them responded that they use spring water for drinking.

Concerning boiling water, among those Bedouin women who were tested positive (56); negative (19); and Greyzone (3), all responded that they boil the well and or spring water.

Among those children who were born for Bedouin mothers in the year 2000 (52), 23.1%, 9.6%, 5.8%, 44.2%, and 17.3% were residing in Khan Ahmar, Ein Eduk, Jericho, Oja, and Fasaeil respectively. Three children (5.8%) were tested positive and all of them were residing in Fasaeil.

Concerning consumption of raw meat by children born for Bedouin women in the year 2000, results showed the following: among those children who were born in the year 2000, 36.5% of families responded that they consume raw meat and 63.5% do not consume raw meat. Among those children who were positive (3), all of their mothers responded that they do not consume raw meat. Among those children who were tested negative (23), 30.4% of their families responded that they do not consume raw meat and 69.6% of their families consumed raw meat.

Toxoplasmosis result of children born in the year 2001 and their residence showed the following: 15.6%, 13.3%, 6.7%, 40% and 24.4% of them were residing in Khan Ahmar, Ein Eduk, Jericho, Oja, and Fasaeil respectively. Two children were tested positive and born in Fasaeil. Among those children who were born in the year 2001 and tested negative (29), 24.1% , 6.9%, 37.9%, and 31% were residing in Khan Ahmar, Ein Eduk, Oja, and Fasaeil respectively. Chi-square test showed that there is a relation between the Toxoplasmosis results of children born in the year 2001 and their place of residence [$\chi^2 (16) = 32.7, p < .01$].

Among the total children (45) born in the year 2001 for Bedouin women, 33.3% of their families said that they consume raw meat and 66.7% do not consume raw meat. Two children were positive and their families do not consume raw meat. Among those children of Bedouin women who were tested negative (29), 37.9% of their families consume raw meat and 62.1% do not consume raw meat.

Among the total children (39) born in the year 2002 for Bedouin women, 15.4%, 12.8%, 7.7%, 38.5%, and 25.6% were residing in Khan Ahmar, Ein Eduk, Jericho, Oja, and Fasaeil respectively. All those children born in the year 2002 were tested negative.

Among those children born in the year, 2002 for Bedouin women showed the following: 30.8% of those children said that their families consume raw meat while 69.2% do not. All of children (39) were tested negative.

Concerning those children (61) born in the year 2003 for Bedouin women and their place of residence, results showed the following: 21.3%, 14.8%, 3.3%, 34.4%, and 26.2% were residing in Khan Ahmar, Ein Eduk, Jericho, Oja, and

Fasaeil. Among those children (61) born in the year 2003, three children were positive (one in Jericho, Oja, and Fasaeil). Eleven children were tested negative and three children were tested Greyzone (one in Khan Ahmar and two in Oja). Chi-square test showed that there is no relation between the Toxoplasmosis results of children born in the year 2003 and their place of residence [$\chi^2 (16) = 17.01, p > .01$].

Toxoplasmosis of children born in the year 2003 and consumption of raw meat showed the following: among the total children born in the year 2003, 32.8% of families responded that they consume raw meat and 67.2% responded that they do not consume raw meat. Three children were tested positive (33.3% of their families consume raw meat and 66.7% do not consume raw meat. Eleven children were tested negative and three children were tested Greyzone.

Toxoplasmosis result of children born in the year 2000 and raising cats at home showed the following: 75% of those children (52) born in the year 2000, their mothers responded that they raise cat sat home and 25% do not raise cat sat home. Among those who responded yes to raising cats at home, three children were tested positive. Among those children who were tested negative (23), 65.2% of their mothers responded that they raise cats at home and 34.8% responded that they do not raise cats at home.

Concerning Toxoplasmosis result of children born in the year 2000 for Bedouin women and where cats live showed the following: 25% of those children tested, their mothers did not respond to this question: 5.8% responded that cats live indoor and 69.2% responded that cats live outdoor. Those children who were tested positive (3), their mothers responded that

cats live outdoor. Among those children who were tested negative (23), 34.8% of them their mothers did not respond, 4.3% and 60.9% of the same children, their mothers responded that cats live indoor and outdoor respectively. Concerning Toxoplasmosis result of children born in the year 2000 for Bedouin women and where cats pass stool showed the following: 25%, of those children born in the year 2000, their mothers did not respond and 75% responded that cats pass stool outdoor. All those children who were tested positive (3), their mothers responded that cats pass stool outdoor. Among those children who were tested negative (23), 34.8% their mothers did not respond and 65.2% responded that cats pass stool outdoor.

Concerning Toxoplasmosis result of children born in the year 2001 for Bedouin women and raising cats at home showed the following: Among those children (45) born in 2001, 75.6% and 24.4% of those children, their mothers responded yes and no to raising cats at home respectively. Among those children tested positive (2), 50% responded yes and no respectively to raising cats at home. Among those tested negative (29), 72.4% and 27.6% of the same children, their mothers responded yes and no respectively to raising cats at home.

Concerning Toxoplasmosis result of children born in the year 2001 for Bedouin women and place where cats live showed the following: Among those children (45) who were born in the year 2001, 24.4% of those children, their mothers did not respond; 6.7% and 68.9% of the same children, their mothers responded that cats live indoor and outdoor respectively.

Concerning Toxoplasmosis result of children born in the year 2001 for Bedouin women and where cats pass stool showed the following: 24.4% of

those children (45) born in the year 2001, their mothers did not respond while 75.6% of the same children, their mothers responded that their cats pass stool outdoor. Among those children who were tested positive (2), 50% of their mothers did not respond and the other 50% responded that their cat outdoor. Among those children who were tested negative (29), 27.6% their mothers did respond and 72.4%, their mothers responded that their cats pass stool outdoor.

Toxoplasmosis result of children (39) born in the year 2002 for Bedouin women and raising cats at home showed the following: Among those children (39) who were born in the year 2002, 66.7% and 33.3% of those children's mothers responded that yes and no respectively to raising cats at home. None of those children was tested positive. Among those who were tested negative (39), 79.5% of them, their mothers responded that they raise cats at home while, 20.5% responded that they do not raise cats at home.

Toxoplasmosis result of children (39) born in the year 2002 for Bedouin women and where cats live showed the following: among those children who were tested negative (39), 20.5% of children's mothers did not respond; 5.12% and 74.36% their mothers responded that their cats pass stool indoor and outdoor respectively.

Concerning Toxoplasmosis, result of children (39) born in the year 2002 for Bedouin women and where cats pass stool showed the following: 20.5% of all children tested negative (39), their mothers did not respond, while 79.5% of the same children, their mothers responded that their cats pass stool outdoor.

Toxoplasmosis result of children (61) born in the year 2003 for Bedouin women and raising cats at home showed the following: 72.1% and 27.9% of

children's mothers responded yes and no respectively to raising cats at home. Among those children who were tested positive (3), 66.7% and 33.3% of those children's mothers responded yes and no respectively to raising cats at home. Among those tested negative (11), 90.9% and 9.1% of children's mothers responded respectively to raising cats at home. Among those children, tested Greyzone (3), 33.3% and 66.7% of children's mothers responded yes and no to raising cats at home.

Toxoplasmosis results of children (61) born in the year 2003 for Bedouin women and where cats live showed the following: among the total number of the children, 27.9% of children's mothers did not respond. Among those children who were tested positive (3), 33.3% of children's mothers did not respond and 66.7% of the same children responded that their cats pass stool outdoor. Among those children who were tested negative (11), 9.1% of children's mothers did not respond, while, 18.2% and 72.7% of children's mothers responded that their cats live indoor and outdoor respectively. Among those children who were, tested Greyzone (3), 33.3% of children's mothers did not respond and 66.7% responded that their cats live outdoor. Toxoplasmosis result of children born in the year 2003 for Bedouin women and where cats pass stool showed the following: Among those tested positive (3), 33.3% of children's mothers did not respond while, 66.7% of children's mothers responded that their cats pass stool outdoor. Among those children who were tested negative (11), 9.1% of children's mothers did not respond and 90.9% of the same children's mothers responded that their cats pass stool outdoor. Among those children who were tested Greyzone (3), 66.7% of

children's mothers did not respond while, 33.3% of child's mother responded that their cat pass stool outdoor.

Concerning Toxoplasmosis result of children (52) born in the year 2000 for Bedouin women and feeding of cats on remnants of slaughter showed the following: All women responded that they feed cats on remnants of slaughter. All those children (3) who were tested positive, their mothers responded that cats are fed on remnants of slaughter. Among those children who were tested negative, their mothers responded that cats are fed on remnants of slaughter in 95.7% of cases.

Toxoplasmosis result of children born in the year 2000 for Bedouin mothers and hand washing when contacting the soil showed the following: 30.8%, 34.6%, and 34.6% of those children, their mothers responded that hand washing is done, no hand washing, and sometime hand washing is carried out respectively. Among those children (3) who were tested positive, 66.7% and 33.3% of respondents responded that no hand washing and sometime hand washing is carried out respectively. Among those children (23) who were tested negative, 17.4%, 52.2% and 30.4% of respondents said that hands of their children are washed, no hand washing and sometime hand washing is done.

Concerning Toxoplasmosis result of children born in the year 2001 for Bedouin women and hand washing when contacting the soil showed the following: 24.4%, 48.9% and 26.7% of those children their mothers responded that their children wash hands, do not wash their hands, and sometimes wash their hands respectively. Among those children (2) who were tested positive, both of them their mothers responded that they do not wash their hands.

Among those children who were tested negative (31), 31%, 22.6%, and 48.3% of those children, their mothers responded that their children wash their hands, don not wash their hands, and sometimes wash their hands respectively.

Concerning Toxoplasmosis result of children born in the year 2000 for Bedouin women and washing vegetables and fruits before eating them showed the following: 76.9%, 1.9%, and 21.2% of those children who were born in the year 2000, their mothers' responded that they wash vegetables and fruits before eating respectively. Among those children (3) who were tested positive, 66.7% and 33.3% of respondents responded that they wash vegetables and fruits before eating and no washing is carried out respectively. Among those children who were tested negative (23), 52.2% and 47.8% of respondents said that they wash and do not wash vegetables and fruits before eating respectively. Chi-square test showed that there is a relation between the positive Toxoplasmosis results of children born in the year 2000 and washing of vegetables and fruits before eating [$\chi^2 (4) = 18.07, p < .01$].

Concerning Toxoplasmosis result of children born in the year 2001 for Bedouin women and feeding of cats on remnants of slaughter showed the following: all of respondents (45) said that they feed their cats on remnants of slaughter. Among those who were tested positive (2), all of mothers responded that they feed their cats on remnants of slaughter. Among those who were tested negative (30), 96.7% of respondents that they feed their cats on remnants of slaughters. Among those who were tested Greyzone (1), respondent said that their cat is fed on remnants of slaughter.

Among those children (45) born in 2001 for Bedouin women and tested, 24.4%, 48.9% and 26.7% of respondents responded that their children wash their hand, do not wash their hands, and sometimes they do wash their hands when contacting the soil respectively. Not all those children who were tested positive (2) wash their hands. Among those who were tested negative (30), 31% of respondents said that their children wash hands, 23.3% of respondents said that their children do not wash their hands and 46.7% of respondents responded that sometime their children wash their hands. One child tested Greyzone responded that he/she does not wash hands.

All of those children born in 2001 for Bedouin women and tested positive (2), responded that they do wash vegetables and fruits before eating them. Among those children (30) who were tested negative, 60%, 3.33%, and 30% of mothers responded that their children wash, do not wash, and sometime wash vegetables and fruits before eating them. One child who was tested Greyzone; his/her mother responded that the child washes vegetables and fruits before eating them.

Toxoplasmosis result of children born (39) in the year 2002 for Bedouin women, and feeding of cats on remnants of slaughter showed the following: no one was tested positive. Among those children who were tested negative (39), 97.4% of mothers responded that they feed cats on remnants of slaughter and only one family does not feed its cat on remnants of slaughter. Chi-square test showed that there is a relation between the Toxoplasmosis results of children born in the year 2002 and feeding of cats on remnants of slaughter [$\chi^2 (2) = 7.78, p < .01$].

Regarding Toxoplasmosis result of children born in the year 2002 for Bedouin women and hand washing when contacting the soil, results showed the following: among those children (39) who were tested, 28.2%, 41% and 30.8% of mothers responded that their children wash, do not wash, and sometime wash their hand when contacting the soil respectively. No single child was tested positive. Among those children who were tested negative (39), 23.1%, 41%, and 35.9% of mothers responded that their children wash, do not wash, and sometime wash their hands respectively.

Concerning Toxoplasmosis result of children born in the year 2002 for Bedouin women and washing of vegetables and fruits before eating showed the following: among total children tested (39), 69.2%, 2.6% and 28.2% of mothers responded that their children wash, do not wash, and sometime wash vegetables and fruits before eating them. Among those children who were tested negative (39), 69.2%, 2.6%, and 28.2% of mothers responded that their children wash, do not wash, and sometime wash vegetables and fruits before eating.

Among the total tested children (61) born in 2003 for Bedouin women, 98.4% of mothers responded that they feed their cats on remnants of slaughter. All those children (3) who were tested positive, their mothers responded that they feed their cats on remnants of slaughter. All those children who were tested negative (11), all their mothers responded that they feed cats on remnants of slaughter. All those children who were tested Greyzone (3), all their mothers responded that they feed their cats on remnants of slaughter.

Among total children (61) born in 2003 for Bedouin women, and tested, 24.6%, 39.3% and 36.1% of mothers responded that they wash, do not wash,

and sometime wash the hands of their children when contacting the soil respectively. Among those who were tested positive (3), 66.7% and 33.3% of mothers responded that they do not wash and sometime wash the hands of children. Among those children who were tested negative (11), 36.4%, 45.5%, and 18.2% of mothers responded that they wash, do not wash and sometime wash the hands of children respectively. Among those children who were tested Greyzone (3), 33.3% of mothers in each category responded that they wash, do not wash and sometime wash the hands of children respectively.

Concerning Toxoplasmosis result of children born in the year 2003 for Bedouin women and washing vegetables and fruits before eating them showed the following: among total children (61) who were tested, 67.2%, 3.3% and 29.5% of mothers responded that they wash, do not wash and sometime wash hands of children respectively. All the children who were tested positive (3), their mothers responded that they wash vegetables and fruits before eating them. Among those children who were tested negative (11), 81.8% and 18.2% of their mothers responded that they wash and sometime wash vegetables and fruits before eating them. Among those who were tested Greyzone (3), 33.3% and 66.7% of their mothers responded that they wash and sometime wash vegetables and fruits before eating them respectively.

Toxoplasmosis result of children born in the year 2000 for Bedouin women and source of drinking water showed the following: Among those children (52) who were born in the year 2000, their mothers responded that 50%, 38.5% and 11.5% of their drinking water comes from wells, spring and piped and well respectively. All those children who were tested positive (3), their mothers

responded that they use well water for drinking. Among those children who were tested negative (23), 65.2% and 34.8% of their mothers responded that wells and springs are their source of drinking water respectively. Children born in the year 2000 and boiling of well and spring water showed the following; all those children who were tested both positive and negative do not boil the water.

Regarding Toxoplasmosis result of children born in the year 2001 for Bedouin women and source of drinking water showed the following: 57.8%, 37.8%, and 4.4% of mothers responded that wells, springs, and piped and wells are their source of drinking water respectively. All those children who were tested positive (2), spring water was their source of drinking water. Among those children who were tested negative (30), 56.7%, 30%, and 13.3% their mothers responded that their source of drinking water was wells, springs, and piped and well water respectively. One child was tested Greyzone, his mother responded that their source of drinking water was well.

All those children who were tested positive, negative and Greyzone their mothers responded that they do not boil the well and spring water.

Concerning Toxoplasmosis result of children born in the year 2002 for Bedouin women and source of water showed the following: 59%, 38.5 and 2.6% of mothers responded that they use well, spring, and piped and spring water as a source for drinking respectively. Among those children (39) who were tested negative, 53.8%, 33.3% and 12.8% of mothers responded that they use well, spring, and piped and spring water as a source of drinking respectively. Chi-square test showed that there is a relation between the

Toxoplasmosis results of children born in the year 2002 and source of drinking water [$\chi^2 (4) = 13.171, p < .01$].

Regarding Toxoplasmosis result of children born in the year 2002 for Bedouin women and boiling of well or spring water showed the following: All of respondents said that they do not boil water. All children who were tested negative.

Regarding Toxoplasmosis result of children who were born in the year 2003 for Bedouin women and source of drinking water showed the following: Among those tested children (61), 60.7%, 29.5% and 9.8% of mothers responded that they use well, spring, and piped and spring water for drinking respectively. Among those children who were tested positive (3), 66.7% and 33.3% of mothers responded that they use well and spring water for drinking respectively. Among those children who were tested negative (11), 36.37% and 63.63% of mothers responded that they use well and spring water as a source of drinking respectively. Toxoplasmosis result of children born in the year 2003 and boiling of water showed the following: all children (61) who were tested positive, negative and Greyzone, their mothers responded that they do not boil well or spring water before drinking.

Toxoplasmosis result of children born in the year 2000 for Bedouin women and sleeping of cats with children showed the following: Among all tested children (52), 13.5%, 34.6%, and 51.9% of mothers responded that cats sleep, do not sleep and sometime sleep with their children. Among those children who were tested positive (3), 66.7% and 33.3% of mothers responded that cats do not sleep and sometime sleep with their children. Among those children (23) who were tested negative, 13%, 60.9% and 26.1%

of their mothers responded that cats sleep, do not sleep and sometime sleep with their children respectively.

Toxoplasmosis result of the children born in the year 2000 for Bedouin women and play of children with cats showed the following: Among all those children (52) born in the year 2000, 78.8%, 5.8%, 9.6% and 5.8% of their mothers responded that children play, do not play, sometime play and did not answer this question respectively. All those children who were tested positive (3), their mothers responded that children play with cats. Among those children who were tested negative (23), 60.9%, 17.4%, 17.4% and 4.3% of their mothers responded that children play, do not play, sometime play and did not respond to this question respectively.

Toxoplasmosis result of children born in the year 2000 for Bedouin women and washing hands of children after playing with cats showed the following: Among all children (52) who were tested, 9.6%, 67.3% and 23.1% of their mothers responded that children wash, do not wash, and sometime wash their hands respectively. Among those children who were tested positive (3), 66.7% and 33.3%, their mothers responded that children do not wash and sometime wash hand after play with cats. Among those children who were tested negative (23), 8.7%, 47.8% and 43.5% of their mothers responded that children wash, do not wash and sometime wash their hands respectively.

Toxoplasmosis result of children born in the year 2001 for Bedouin women and sleeping of cats with children showed the following: Among all children who were tested (45), 13.3%, 48.9% and 37.8% of their mothers responded that children sleep, do not sleep and sometime sleep with children respectively. Among those children who were tested positive (2), 50% and

50% of mothers responded that their children do not sleep and sometime sleep with cats respectively. Among those children tested negative (31), 12.9%, 32.3% and 51.6% of mothers responded that their children sleep, do not sleep and sometime sleep with cats respectively. The only child tested Greyzone; his mother responded that he does not play with cats.

Regarding Toxoplasmosis of children born in the year 2001 for Bedouin women and play of children with cats showed the following: Among all children (45) tested, 64.4%, 11.1%, 17.8% and 6.7% of their mothers responded that children play, do not play, sometime play with cats and no respond respectively. The two positive children, their mothers responded that both children play with cats. Among those children (31) who were tested negative, 90.3%, 6.5% and 3.2% of mothers responded that their children play, do not play and sometime play with cats respectively. The only child who was tested Greyzone; his mother responded that sometime he played with cats. Chi-square test showed that there is a relation between the Toxoplasmosis results of children born in the year 2001 and play of children with cats [$\chi^2 (12) = 26.27, p < .05$].

Among those children (45) born in 2001 and tested, 8.9%, 53.3%, and 37.8% of their mothers responded that children wash, don not wash, and sometime wash hands respectively. The only two children tested positive, 50% and 50% of mothers responded that their children do not wash and sometime wash hands after play with cats. Among those children (31), who were tested negative, 9.7%, 74.1%, and 16.2% of their mothers responded that children wash, do not wash, and sometime wash hands after play with cats. The only

child tested Greyzone; his mother responded that no hand washing is carried out.

Regarding Toxoplasmosis result of children in the year 2002 for Bedouin women and sleeping of cats with children showed the following: Among total tested children (39), 15.4%, 43.6% and 41% of their mothers responded that cats sleep, do not sleep and sometime sleep with children respectively. No child was tested neither positive nor Greyzone. Among those children who were tested negative (39), 10.3%, 43.6% and 46.1% of mothers responded that cats sleep, do not sleep and sometime sleep with children respectively. Among the total children (39) born in the year 2002 for Bedouin women, 71.8%, 2.6%, 17.9% and 7.7% of mothers responded that their children play, do not play, sometime play with cats and the last rate for those mothers who did not reply this question. No one child was tested positive. Among those children (39) who were tested negative, 76.9%, 15.4%, 5.1% and 2.6% of mothers responded that their children play, do not play, sometime play with cats and no answer respectively.

Concerning Toxoplasmosis result of children born in the year 2002 for Bedouin women and hand washing of children after play with cats showed the following: Among the total children (39) tested, 7.7%, 71.8%, 20.5% of mothers responded that their children wash, do not wash, and sometime wash hands after play with cats respectively.

Toxoplasmosis result of children born in the year 2003 for Bedouin women and sleeping of cats with children showed the following: among those children (61) born in 2003 for Bedouin women and tested, 9.8%, 42.6% and 47.5% of mothers responded that their cats sleep, do not sleep and sometime sleep

with children. Among those children (3) who were tested positive, 33.3% and 66.3% Of mothers responded that cats sleep and do not sleep with their children respectively. Among those children (11) who were tested negative, 27.3%, 27.3% and 45.4% of mothers responded that cats sleep, do not sleep and sometime sleep with their children respectively. All those children (3) who were tested Greyzone; their mothers responded that cats do not sleep with children. Chi-square test showed that there is a relation between the Toxoplasmosis results of children born in the year 2003 and sleeping of cats with children [$\chi^2 (8) = 17.61, p < .01$].

Concerning Toxoplasmosis result of children who were born in the year 2003 for Bedouin women and play of children with cats showed the following: among the total children (61) tested, 72.1%, 9.8%, 13.1% and 4.9% of mothers responded that their children play, do not play, sometime play and no answer respectively. All those children (3) who were tested positive, their mothers responded that children play with cats. Among those children (11) tested negative, 90.9% and 9.1% of mothers responded that their children play and do not play with cats respectively. Among those children (3) who were tested Greyzone, 33.4%, 33.3% and 33.3% of mothers responded that their children play, do not play and sometime play with cats respectively.

Among those children (61) born in 2003 for Bedouin women and tested, 9.8%, 59% and 31.2% of mothers responded that their children wash, do not wash and sometime wash their hands respectively. Among those children (3) who were tested positive, 66.7% and 33.3% of mothers responded that their children do not wash and sometime wash their hands after play with cats. Among those children (11) who were tested negative, 72.7% and 27.3% of

mothers responded that their children do not wash and sometime wash their hands after play with cats. Among those children (3) who were tested Greyzone, 33.3% and 66.7% of mothers responded that their children wash and do not wash hands respectively.

Regarding Toxoplasmosis result of children born in the year 2000 for Bedouin women and play of children with soil showed the following: among those children (52) tested, 86.5%, 3.8% and 9.6% of mothers responded that their children play, do not play and sometime play with soil respectively. Among those children (3) tested positive, 66.7% and 33.3% of mothers responded that their children play and sometime play with soil respectively. Among those children (23) who were tested negative, 95.7% and 4.3% of mothers responded that their children play and do not play with soil respectively.

Concerning Toxoplasmosis result of children who were born in the year 2001 for Bedouin women and play of children with soil showed the following: among those children (45) who were tested, 88.9%, 4.4% and 6.7% of mothers responded that their children play, do not play and sometime play with soil respectively. All the two children who were tested positive, their mothers responded that their children sometime play with soil. Among those children (31) who were tested negative, 96.8% and 3.2% of mothers responded that their children play and sometime play with soil respectively. The only child who was tested Greyzone; his mother responded that does not play with soil. Chi-square test showed that there is a relation between the Toxoplasmosis results of children born in the year 2001 and play of children with soil [$\chi^2 (8) = 51.24, p < .05$].

Among all those children (45) born in 2001 for Bedouin women and tested, 8.9%, 53.3% and 37.8% of mothers responded that their children wash, do not wash and sometime wash hands respectively. Among those children (2) who were tested positive, 50% and 50% of mothers responded that their children do not wash, and sometime wash their hands respectively. Among those children (31) who were tested negative, 9.7%, 71%, and 16.1% of mothers responded that children wash, do not wash and sometime wash their hands respectively. The only child who was tested Greyzone; his mother responded that he did not wash his hands after play with cats.

Regarding Toxoplasmosis result of children who were born in the year 2002 for Bedouin women and play of children with soil showed the following: among total tested children (39), 92.3%, 2.6%, and sometime of mothers responded that their children play, do not play and sometime play with soil respectively. No child was tested positive. Among those children (39) who were tested negative, 84.6%, 5.1%, and 10.3% of mothers responded that their children play, do not play and sometime play with soil respectively.

Concerning Toxoplasmosis result of children born in the year 2002 for Bedouin women and hand washing after play with cats showed the following: among those children (39) who were born, 7.7%, 71.8% and 20.5% of mothers responded that their children wash, do not wash and sometime wash hands after play with cats. No one child was tested positive. Among those children (39) who were tested negative, 10.3%, 51.3% and 38.5% of mothers responded that their children wash, do not wash and sometime wash hands respectively.

Regarding Toxoplasmosis result of children born in the year 2003 for Bedouin women and play of children with soil showed the following: among total children (61) who were tested, 86.9%, 4.9% and 8.2% of mothers responded that their children play, do not play and sometime play with soil respectively. All three children who were tested positive, their mothers responded that their children play with soil. Among those children (11) who were tested negative, 90.9%, and 9.1% of mothers responded that their children play and sometime play with soil respectively. All the three children who were tested Greyzone; their mothers responded that children play with soil.

Among total children (61) born in 2003 for Bedouin women and tested, 9.8%, 59% and 31.1% of mothers responded that their children wash, do not wash and sometime wash with hands after play with cats.

II Cross tabulation for semi-Bedouin variables:

Cross-tabulation of age at the time of the study and toxoplasmosis result of semi-Bedouin (62) showed the following: total positive women 22 that make 35.5% of the total. Total negative women (37) that make 59.7% of the total and 3 is Greyzone (4.8%). The highest positives were among age group (27-31y). The second highest positives (18.52%) were among the age groups (17-21y) and (37-41y) equally. The highest negatives (37.5%) were among age group (22-26y) and the second highest negatives (25%) were among age group (27-31y). The highest Greyzone were among age group (27-31y).

Age of the semi-Bedouin mothers at the time of study and resident showed the following: 67.7% of mothers at the control group reside in Zbeidat and 32.3% reside at Marj Naaja. Among those mothers who reside at Zbeidat, 31% of mothers were at the age group 22-26 years and the least (4.8%) was

the age group 37-41 years. Among those mothers who reside in Marj-Naaja, 50% of mothers were at the age group 27-31 years and the least (5%) was the age group 22-26, 32-36 and 42-46 years respectively. Among both residents, the highest (30.6%) age group was 27-31` years and the least age group (6.5%) was 42-46 years. Chi-square test showed that there is a relation between the age of semi-Bedouin women at the time of study and residence [$X^2 (5) = 12.32, p < .05$].

Toxoplasmosis result of the semi-Bedouin women and toxoplasmosis result of their children born in the year 2000 showed the following: Among those women (22), who were tested positive, none of the children was tested positive and seven children were tested negative. Among those mothers who were tested negative, one child was tested positive and five children were tested negative.

Toxoplasmosis result of the semi-Bedouin women and toxoplasmosis result of their children born in the year 2001 showed the following: Among those women (22) who were tested positive, one child was tested positive and nine children were tested negative. Among those mothers who were tested negative, none of the children were tested positive and 13 children were tested negative. Among those women who were tested Greyzone, none of the children were tested positive and only one child was tested negative.

Toxoplasmosis result of the semi-Bedouin women and toxoplasmosis result of their children born in the year 2002 showed the following: among those women (22), who were tested positive, none of the children were tested positive and eight children were tested negative. Among those mothers who

were tested negative, one child was tested positive and seven children were tested negative.

Concerning Toxoplasmosis result of semi-Bedouin women and toxoplasmosis result of their children born in the year 2003 showed the following: Among those mothers, who were tested positive, none of the children were tested positive and four children were tested negative. Among those children who were tested negative, one child was tested positive and seven children were tested negative. Among those mothers who were tested Greyzone, only one child was tested negative.

Residence and toxoplasmosis result of children who were born in the year 2000 for semi-Bedouin women showed the following: In Zbeidat village, one child was tested positive and eight children were tested negative. In Marj Naaja village, none of the children were tested positive and four children were tested negative.

Residence and toxoplasmosis result of children who were born in the year 2001 for semi-Bedouin women showed the following: In Zbeidat village, one child was tested positive and fourteen children were tested negative. In Marj Naaja village, none of the children were tested positive and nine children were tested negative.

Residence and toxoplasmosis of children who were born in the year 2002 for semi-Bedouin women showed the following: In Zbeidat village, none of the children were tested positive and 11 children were tested negative. In Marj Naaja village, one child was tested positive and four children were tested negative.

Residence and toxoplasmosis result of children who were born in the year 2003 for semi-Bedouin women showed the following: In Zbeidat village, one child was positive and seven children were tested negative. In Marj Naaja village, none of the children were tested positive and five children were tested negative.

Age of mothers at the time of the study and toxoplasmosis result of mothers showed the following: Among the semi-Bedouin women (62) who were tested, 43.5%, 51.6% and 4.8% of mothers were positive, negative and Greyzone respectively. Among those mothers who were tested positive, the highest percentage (33.3%) was at the age group 27-31 years and the least (7.4%) was at the age group 22-26 years. On the other hand, among those mothers who were tested negative, the highest percentage (37.5%) was at age group 22-26 years and the least (0.0%) was at age group 37-41 years. Among those mothers who were tested Greyzone, the highest percentage (66.7%) was at age group 27-31 years.

Age of semi-Bedouin mothers at the time of the study and their educational level showed the following: Among all age groups, 8.1%, 30.6%, 33.9%, 25.8% and 1.6% of control mothers were illiterate, educated until elementary, preparatory, secondary and diploma levels respectively. Among the age group 17-21 years, the highest educational levels were at preparatory and secondary levels (41.7%), the least were at the illiterate, and diploma levels (0.0%). Among the age group 22-26 years, the highest educational level was at the preparatory level (42.9%) and the least level was at the diploma level (0.0%). Among the age group 27-31 years, the highest educational level was at the elementary level (42.1%) and the least were both at the illiterate and

diploma levels. Among the age group 32-36 years, the highest educational levels were both at the elementary and preparatory levels (28.6%) and the least were at illiterate, secondary and diploma levels respectively. Among the age group 37-41 years, the highest educational levels were both (at the illiterate and elementary levels) and the least at the secondary level. Among the age group 42-46 years, the highest educational level was at the elementary level (50%) and the least educational levels were at both secondary and diploma levels.

Age of semi-Bedouin mothers at first marriage and their toxoplasmosis result showed the following: Among the total semi-Bedouin mothers (62) at first marriage and toxoplasmosis tests results, 22 mothers (35%), 37 mothers (60%), three women (5%) were tested positive, negative and Greyzone respectively. Among the age group 14-18 years, 9.8% and 4.9% of mothers were tested positive and negative respectively. Among the age group 19-23 years, 7.1% were tested equally both positive and do not remember respectively. Among the age group 24-28 years, 14.3% and 28.6% of mothers were tested positive and negative respectively. Chi-square test showed that there is a relation between age of semi-Bedouin mothers at first marriage and toxoplasmosis result of semi-Bedouin [$\chi^2 (6) = 17.059, p < .05$].

Age of semi-Bedouin mothers at the time of study and number of children in the family showed the following: Among the total semi-Bedouin mothers (62), 58%, 37% and 5% of mothers have children in groups of 0-4, 5-9 and ≥ 10 . Among the age group 17-21 years, 19.4% of total children were having children only at the group of 0-4. The age group 22-26 years has 22.6% of total children (71.4% and 28.6% of mothers at the same age group were

having children at groups of 0-4 and 5-9 respectively). The age group 27-31 years has 30.6% of total children (52.6% and 47.4% of mothers were having children at groups of 0-4 and 5-9 respectively). The age group 32-36 years has 11.3% of total children (28.6%, 57.1% and 14.3% of mothers were having children at groups of 0-4, 5-9 and ≥ 10 respectively). The age group 37-41 years has 9.7% of total children (33.3% and 66.7% of mothers were having children at groups of 0-4 and 5-9 respectively). The age group 42-46 years has 6.5% of total children (50% and 50% of mothers were having children at groups of 5-9 and ≥ 10 respectively). Chi-square test showed that there is a relation between age of semi-Bedouin mothers at the time of the study and number of children of each age group [$\chi^2 (10) = 36.4, p < .05$].

Chapter Five

Interpretation and Discussion:

This chapter will address the interpretation and discussion of the study findings. The first section will review the purpose and design of the study. The second part will provide interpretation and discussion of the study results. Finally, the third section will provide a focus on conclusions and recommendations.

Section one: The purpose of this study was to compare case-control of toxoplasmosis in Bedouin and semi-Bedouin women and their children in Jericho District and to answer the following questions:

- What is the spread of toxoplasmosis infection among the case and control Bedouin and semi-Bedouin groups in Jericho District?
- What are the contributing factors to the spread of the infection?
- Is there a difference in daily living patterns among Bedouins and semi-Bedouins?

To fulfill the purpose of the study, a comparative study was conducted among Bedouin and semi-Bedouin women and their children who were residing in tents and semi-houses in Jericho District. A locally designed questionnaire that included both close and open-ended questions was used.

Section two: This section will present discussion and interpretation of demographic variables, history of pregnancy, environmental risk factors contributing to spread of Toxoplasma infection and exposure of children to Toxoplasma infection.

In this study, seropositivity for toxoplasmosis increase in both Bedouin and semi-Bedouin groups with age and this is congruent with the findings of Punda-polić et al. About $\frac{3}{4}$ (73%) of Bedouin mothers are seropositive to toxoplasmosis, while in semi-Bedouin about 34% are seropositive. Residence of Bedouin has no impact of toxoplasmosis results of mothers [$X_2(8) = 10.71, p > .01$]. There is no relation between consumption of meat and toxoplasmosis result of mothers [$X_2(2) = 5.01, p > .01$]. In addition, there is no relationship between toxoplasmosis result of mothers and washing hands and utensils after processing raw meat [$X_2(4) = 1.84, p > .01$] and [$X_2(4) = 2.77, p > .01$] respectively. Chi-square showed that there is no relation between sera- result of mothers and raising cattle at home [$X_2(2) = 3.37, p > .01$]. However, there is a great evidence that there is a strong relationship between toxoplasmosis result of mothers and feeding of cats on remnants of slaughter [$X_2(2) = 25.3, p < .01$]. Statistical analysis showed that there is a strong relation between toxoplasmosis of mothers and washing vegetables and fruits before eating [$X_2(4) = 15.95, p < .01$]. Water was a risk factor in transmitting toxoplasmosis among children born in 2002 [$X_2(4) = 13.17, p < .05$]. There is a relationship between toxoplasmosis result of children born in 2001 and play of children with cats [$X_2(12) = 22.27, p < .05$]. Statistical analysis showed that that there is a relationship between toxoplasmosis result of children born in 2003 and sleeping of cats with children [$X_2(8) = 17.61, p < .05$]. There is a relationship between toxoplasmosis result of children born in 2001 and play of children with soil [$X_2(8) = 51.24, p < .01$]. Statistical analysis showed that there is a relationship between the age of mothers at the time

of study and residence [$\chi^2 (5) = 12.32, p < .05$]. This shows the great influence of environment on health of humans especially in this case, females. This could be explained that those people (semi-Bedouin) are far more in close contact with soil than the cases group because of farming. There is a relationship between age of mothers at first marriage and toxoplasmosis result [$\chi^2 (6) = 17.06, p < .01$]. In addition, there is a relationship between the age of women and number of children. This means that the more mothers have children, the more they are prone to Toxoplasma infection.

Conclusion:

In conclusion, environmental factors such as farming without protective gloves or washing hands, fruits and vegetables, raising, playing with cats, and soil play a big role in contacting this disease. It is an interesting note that feeding cats on remnants of slaughter, which culturally practiced, has proven its strong relationship with spreading the Toxoplasma infection especially in those open areas where uncontrolled (unlawful) slaughtering is practiced. Although, this disease has a limited impact overall community, however, it has a serious impact on an important sector of the community, that is fertile females and their future offspring. Further more, changing lifestyle of people such as living in high-rise buildings may lead to spread of Toxoplasmosis especially the congenital among newborn babies in the future.

Implications:

This pilot study has very limited contribution to research. Since, it has a small and non-randomized sample. In addition, it is limited to those Bedouin and

semi-Bedouin who actually included in this study. It gives a clue. However, the outcome of this trial cannot be generalized to the whole Bedouin community in the country.

Recommendations:

The following are some of the recommendation that could be carried out in the future:

- 1) Repeat this study on a larger scale on the same community using random sampling.
- 2) Do a comparative study using three samples from three communities such as city, village and camp.
- 3) A selective screening program specifically for pre-school and school females could be implemented to establish a database for this disease.
- 4) A follow up longitudinal study could be initiated to identify incidence, prevalence and attack rates. In addition to identifying the environmental factors that are applicable to our culture that may differ than the well established ones.
- 5) Increase awareness of people through pamphlets targeting specifically females.

Community education:

- Wash hands with soap and water when exposed to soil, raw meat, or unwashed fruits and vegetables.
- Cook the meat, poultry thoroughly (boil for one hour or stew well).
- When cooking meat, avoid tasting it before it is fully cooked.
- Freeze meat for few days before cooking.

- If no refrigerator is available, use simple techniques such as salting, drying or roasting to keep meat uncontaminated.
- Wash all cutting board, dishes and knife thoroughly with soap and hot water after each use.
- Wash well fruits and vegetables before eating them.
- Wear gloves (agricultural) when gardening and wash hands well afterward.
- Avoid drinking untreated water.
- Have someone else change litter box of cats on daily basis when pregnant.
- Do not feed cats' raw meat or remnants of slaughter. Feed cats well cooked meat (homemade food).
- Avoid contacting stray cats (especially kittens), dogs and other animals.
- Keep indoor cats indoors and outdoor cats outdoors.
- Control flies and cockroaches as much as possible.
- Avoid eating raw eggs and drinking unpasteurized milk or its products.
- Avoid rubbing eyes or face when preparing meat or poultry for cooking (AVMA, 2005, CDC, 2000).

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Appendices:

Appendix (1):

Questionnaire on Toxoplasmosis

No.: _ _ _

Date: -- / -- / ----

I Demographic Data:

- 1) Age of the mother now:-----
- 2) Age of the mother at first marriage: -----
- 3) Result of Toxoplasmosis for the mother: Positive Negative Grey
- 4) If the result is positive, what was the Titer? -----
- 5) Number of alive children: -----
- 6) Number of children born in the year 2000: None One Two
- 7) DOB: --- /--- / ---
- 8) Gender of the born: Male Two males Female Two females Not applicable
- 9) Result of Toxoplasmosis
 Positive twin one Positive twin two
 Negative twin one Negative twin two Grey Not applicable
- 10) If the result is positive, what was the Titer?
 Twin one titer: ----- Twin two titer: -----
- 11) Number of children born in the year 2001: None One Two.
- 12) DOB: --- /--- / --- Not applicable
- 13) Gender of the born Male Two males Female Two females Not applicable
- 14) Result of Toxoplasmosis
 Positive twin one Positive twin two
 Negative twin one Negative twin two Grey Not applicable
- 15) If the result is positive, what was the Titer?
 Twin one titer: ----- Twin two titer: -----
- 16) Number of children born in the year 2002: None One Two

17) DOB: --- /--- / ---

18) Gender of the born Male Two males Female Two females Not applicable

19) Result of Toxoplasmosis
 Positive twin one Positive twin two
 Negative twin one Negative twin two Grey Not applicable

20) If the result is positive, what was the Titer?
 Twin one titer: ----- Twin two titer: -----

21) Number of children born in the year 2003: None One Two.

22) DOB: --- /--- / ---

23) Gender of the born Male Two males Female Two females Not applicable

24) Result of Toxoplasmosis
 Positive twin one Positive twin two
 Negative twin one Negative twin two Grey Not applicable

25) If the result is positive, what was the Titer?
 Twin one titer: ----- Twin two titer: -----

26) Education: -----

27) Residence: -----

II History of pregnancy:

28) Are you pregnant now? Yes No

29) If the answer to previous question is yes, how many weeks are you pregnant? ----

30) Have you ever aborted? Yes No

31) If the answer to previous question is yes. How many times? (deleted)
 One Two Three Four Five Six

32) Did abortions occur while you were Primigravida? Yes No Not applicable

33) If the answer to previous question is yes, what was the cause?
 Infection Trauma Not known Not applicable

34) Did abortions occur in sequence? Yes No Not applicable

35) How many times did you have stillbirth? None One Two Three

III Environment risk factors:

36) Do you eat meat? Yes No Sometimes

37) If your answer is yes, what kind of meat? Fresh Frozen All

38) If your answer is fresh meat, what part of the animal do you eat?
 Muscles Internal-Organs Both

39) Do you eat raw meat? Yes No Sometimes

40) If the answer to previous question is yes what part?
 Liver Kidney Both Not applicable

41) Do you wash your hands after preparing raw meat for cooking?
 Yes No Sometimes

42) If your answer to previous question is no, do you wear gloves?
 Yes No Sometimes

43) What do you do for utensils used in preparing raw meat?
 Sweep them Clean them with water only Clean them with soap & water

44) How often do you eat meat? One/week Two/week Three/week

45) How long do you cook meat? 15 minutes 30 minutes 60 minutes 90 m.

46) What is your preference in cooking meat? Undercooked Well-cooked
 Both

47) Do you like to eat meat? Cooked Grilled Both

48) Do you raise cattle? Yes No

49) If your answer to previous question is yes. What kind? Sheep Lamb Both
 Cows

50) Who cleans the cattle yard? Men Women Both Not applicable

51) Who milk the cattle? Men Women Both Not applicable

52) Who prepare the diary products? Men Women Both Not applicable

53) Do you raise cats? Yes No.

54) If your answer is yes. How many cat? None One Two Three Four

55) If your answer is yes, do cats live? Indoor Outdoor Both

56) Do cats pass stool? Indoor Outdoor Both

57) Do you feed cats the remnants of your slaughter? Yes No Sometimes

58) Do you plant some vegetables in the vicinity of your house? Yes No

59) If your answer to previous question is yes, do you wash your hands?
 Yes No Sometimes

60) Do you wash your hands when planting the Soil? Yes No Sometimes

61) If your answer to previous question is no, do you put on gloves when planting the Soil? Yes No Sometimes

62) Do you wash fruits and raw vegetables before eating them?
 Yes No Sometimes

1V Knowledge of mother:

63) Have you ever heard of Toxoplasmosis? Yes No

64) Have you ever done a laboratory test for Toxoplasmosis? Yes No

65) If your answer to previous question is yes, what was the result?
 Positive Negative Not known Not applicable

66) If you are tested positive to Toxoplasmosis, were any of your babies/children tested too? Yes No Not applicable

67) If your answer to previous question is yes, what was the result?
 Positive Negative Grey Not applicable

68) Did any family member complain of signs & symptoms of Toxoplasmosis?
 Yes No.

69) If the answer to previous question is yes how many? One Two Not applicable

70) Do you know some signs & symptom of Toxoplasmosis? Yes No

71) If the answer to previous question is yes, what are they?
 No answer Abortion Deformity Infertility All of them

72) How can you avoid Toxoplasmosis?
 Vaccination Washing hands Avoid contact with cats
 Avoid eating raw meat All of them No answer

73) Do you think that you should be tested for Toxoplasmosis? Yes No

74) If your answer to previous question is yes, why? -----

75) If the answer to previous question is no, why? -----
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76) Is there a treatment for Toxoplasmosis? Yes No Don't know

77) What kind of water do you use? Piped Well Both Spring

78) If your drinking water comes from a well or spring, do you boil it? Yes No
 Sometimes

V Exposure of children

79) Does the cat sleep with your child? Yes No Sometimes Not applicable

80) Does your child play with cats? Yes No Sometimes Not applicable

81) Does your child wash his/her hands after play with cats?
 Yes No Sometimes Not applicable

82) Does your child play with the soil? Yes No Sometimes Not applicable

83) If your answer to previous question is yes, what do you do?
 I do nothing Ask him/her to wash hands Give him/her a wash

Appendix (2): Map of Jericho District

