

Risk Factors and Altered Parameters in Pregnant Women Infected by *Toxoplasma gondii* in Lebanon

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Abstract

Toxoplasmosis is a parasitic infection caused by *Toxoplasma gondii*. Both animals and humans could develop the infection through several ways including diet, unhygienic habits, direct contact to soil, blood transfusions and organ grafting. Although all people are at risk of the infection, ones with weakened immune systems are at much higher risk, out of these are cancer patients, pregnant women, fetuses and newborns. In our study, we collected data from three gynecologists in two Lebanese regions in order to evaluate the prevalence of the infection and the risk factors associated with it. We found out that the increase in age and pet ownership is directly correlated with the number of infected women and the infection of the women is directly related to the mode of delivery being c-section and having infected offspring.

Keywords: risk factors, pregnant, toxoplasma

1. Introduction

Toxoplasma gondii is a single-celled parasite that causes human and animal toxoplasmosis. It is wide spread, infecting one third of the human population worldwide. Cats belonging to the family *Felidae* are the only hosts for the sexual stages of this parasite (Jones et al., 2001). *T. gondii* goes through 3 stages in its host: tachyzoites and bradyzoites which occur in body tissues and sporozoites that get excreted in cats' feces. It can be transmitted between warm blood animals and humans through several routes (Guerina & Lee, 2017; Hill & Dubey, 2002). One of the modes of transmission is through ingestion of contaminated fruits, vegetables, raw meat, water and unpasteurized milk in addition to poor hygiene around food and cookware. Another route could be through the direct contact with contaminated soil by gardening and farming or by changing cat litter boxes. Moreover, this parasitic infection could be transmitted through organ transplantation, blood transfusions or open wounds (Soares & Caldeira, 2019; Olariu et al., 2019). One characteristic of this parasite is its ability to survive in its host for prolonged periods of time. Infected individuals do not show any severe symptoms due to their healthy immune system that is keeping the parasite from causing illness (Bernsteen et al., 1999). However, individuals with compromised immune systems and more especially pregnant women should be aware from this parasite infection since multiple health problems could arise and require immediate assistance (Dun et al., 1999).

In normal cases, toxoplasmosis has flu like symptoms but it is serious in cases of comprised immunity like in chemo-treated patients, newborns and pregnant women. Newly infected mothers with *Toxoplasma gondii* during or before pregnancy have a high risk of transmitting this parasite to their infants (Smith, 1999). The risk of toxoplasmosis transmission to a fetus increases greatly depending on the gestational age at maternal infection (Dun et al., 1999). Another factor that influences the occurrence of the infection in pregnant women is the high progesterone level that leads to reducing the cell-mediated immune response which is important against the *T. gondii* so the chances of infection in pregnant women fire up (Olariu, 2019).

The purpose of this study is to estimate the prevalence of toxoplasmosis in pregnant Lebanese women and the risk of congenital infection in their fetuses and newborns on the basis of genetic and environmental factors.

2. Data Collection

The data was collected over a period of two months in Chouf and Saida regions from three gynecologists, Dr. Tatiana Bou Orm, Dr. Alia Chebbo and Dr. Bouchra El-Hajj. The study aimed at studying the frequency of pregnant women infected by *T. gondii*, the factors that influenced the infection and the effect on the fetuses and

newborns of these women. The women in our sample were twenty to forty-five years old. The variables were chosen based on the target of the study which is to check for a relation between the occurrence of ^{the} disease and some genetic, biological and environmental factors. The data was obtained from the patients' files under the Drs'. The variables looked at for the pregnant women were: age, weight, family history, residence, TSH, vit D3, seroprevalence of toxoplasmosis, hemoglobin (Hgb), hepatitis B surface antigen (HBsAg), rubella test, fasting blood sugar level, blood type, week of delivery, method of delivery and pet ownership. As for the babies, we noted their gender and health status. The data was entered into IBM SPSS Software to be organized and summarized in order to clearly analyze it and obtain a solid conclusion.

3. Results

Before testing all the variables that may have a relation with toxoplasmosis, we measured the percentage of women having toxoplasmosis in our sample

3.1 Descriptive Statistics

Toxoplasmosis infection					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	53	45.3	45.3	45.3
	no	64	54.7	54.7	100.0
	Total	117	100.0	100.0	

Percentage of woman infected by toxoplasmosis: 45.3% of pregnant women are infected with toxoplasmosis.

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	[20-30]	26	22.2	22.2	22.2
	[30-40]	31	26.5	26.5	48.7
	[40-50]	60	51.3	51.3	100.0
	Total	117	100.0	100.0	

Age: 51.3% of women are of ages between [40-50]

Owning a pet					
		Frequency	Percent	Valid Percent	Cumulative Percent
	yes	62	53.0	53.0	53.0
	no	55	47.0	47.0	100.0
	Total	117	100.0	100.0	

Owning a pet: 53% of subjects have pet.

Method of delivery					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	29	24.8	24.8	24.8
	c section	88	75.2	75.2	100.0
	Total	117	100.0	100.0	

Method of delivery: 75.2% of subjects delivered by c-section.

Delivery weeks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	[30-37]	10	8.5	8.5	8.5
	[37-40]	84	71.8	71.8	80.3
	[40-41]	23	19.7	19.7	100.0
	Total	117	100.0	100.0	

Week of delivery: 71.8% of newborns were delivered between weeks 37 and 40.

Health status of newborn

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	normal	72	61.5	61.5	61.5
	infected	45	38.5	38.5	100.0
	Total	117	100.0	100.0	

Health status: 38.5% of newborns were infected.

Body weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	[50-65]	33	28.2	28.2	28.2
	[65-79]	43	36.8	36.8	65.0
	[79-94]	28	23.9	23.9	88.9
	[95-109]	9	7.7	7.7	96.6
	[109-135]	4	3.4	3.4	100.0
	Total	117	100.0	100.0	

Body weight: 36.8% of subjects' weigh [65-79] kg

Address

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	city	38	32.5	32.5	32.5
	village	79	67.5	67.5	100.0
	Total	117	100.0	100.0	

Address: 67.5% of subjects live in villages.

Family history

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	31	26.5	26.5	26.5
	no	86	73.5	73.5	100.0
	Total	117	100.0	100.0	

Family history: 26.5% of women have a family history of toxoplasmosis.

Rubella infection

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	88	75.2	75.2	75.2
	no	29	24.8	24.8	100.0
	Total	117	100.0	100.0	

Rubella: 24.8% of pregnant woman were not affected with rubella.

Hbs Ag

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	87	74.4	74.4	74.4
	no	30	25.6	25.6	100.0
	Total	117	100.0	100.0	

Hbs Ag: 74.4% of women have the antigen Hbs Ag.

Hbg

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	[7-10]	17	14.5	14.5	14.5
	[10-14]	100	85.5	85.5	100.0
	Total	117	100.0	100.0	

Hemoglobin level: 85.5% of subjects had a Hg level between [10-14] g/dl.

Vitamin D3 level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Deficiency	100	85.5	85.5	85.5
	Normal	17	14.5	14.5	100.0
	Total	117	100.0	100.0	

Vitamin D3 level: 85.5% of subjects had vit D3 deficiency.

TSH level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	115	98.3	98.3	98.3
	Deficiency	2	1.7	1.7	100.0
	Total	117	100.0	100.0	

TSH: 98.3% of subjects had a normal TSH level.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	75	64.1	64.1	64.1
	female	42	35.9	35.9	100.0
	Total	117	100.0	100.0	

Gender: 64.1% of newborns were males and 35.9 were females.

blood type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A-	1	.9	.9	.9
	A+	31	26.5	26.5	27.4
	AB-	1	.9	.9	28.2
	AB+	12	10.3	10.3	38.5
	B-	5	4.3	4.3	42.7
	B+	20	17.1	17.1	59.8
	O-	4	3.4	3.4	63.2
	O+	43	36.8	36.8	100.0
	Total	117	100.0	100.0	

Blood type: 36.8% of pregnant women were of O+ blood group.

FBS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	[65-80]	28	23.9	23.9	23.9
	[80-120]	78	66.7	66.7	90.6
	[120-180]	11	9.4	9.4	100.0
	Total	117	100.0	100.0	

3.2 Inferential Statistics

Toxoplasmosis infection * age

Research question: Is age a risk factor of toxoplasmosis?

H_0 = age is not a risk factor of toxoplasmosis.

H_a = age is a risk factor of toxoplasmosis.

According to the chi-square test, p-value=0.00 thus p-value<0.05 which implies that it is significant so we reject H_0 and accept H_a .

Crosstab

Count		age			Total
		[20-30]	[30-40]	[40-50]	
toxoplasmosis infection	yes	6	4	43	53
	no	20	27	17	64
Total		26	31	60	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	35.146 ^a	2	.000
Likelihood Ratio	37.700	2	.000
Linear-by-Linear Association	24.521	1	.000
N of Valid Cases	117		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.78.

Toxoplasmosis infection * having pets

Research question: Does having pets increase the chances of being infected with *T. gondii*?

H_0 = having pets doesn't affect the chances of getting infected

H_a = having pets is a risk factor of toxoplasmosis

According to the chi-square test $p=0.00 < 0.05$ so this value is significant and we reject H_0 and accept H_a .

Crosstab

Count		pet		Total
		yes	no	
toxoplasmosis infection	yes	43	10	53
	no	19	45	64
Total		62	55	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	30.801 ^a	1	.000		
Continuity Correction ^b	28.771	1	.000		
Likelihood Ratio	32.593	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	30.538	1	.000		
N of Valid Cases	117				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 24.91.

b. Computed only for a 2x2 table.

Toxoplasmosis infection * method of delivery**Research question: Does toxoplasmosis influence C-section delivery?**

H_0 = Toxoplasmosis isn't related to c-section.

H_a = Toxoplasmosis leads to c-section.

According to the chi-square test $p=0.00 < 0.05$ so this value is significant and we reject H_0 and accept H_a .

Crosstab

Count		method of delivery		Total
		Normal	c section	
toxoplasmosis infection	yes	4	49	53
	no	25	39	64
Total		29	88	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	15.446 ^a	1	.000		
Continuity Correction ^b	13.801	1	.000		
Likelihood Ratio	17.037	1	.000		
Fisher's Exact Test				.000	.000

Linear-by-Linear Association	15.314	1	.000
N of Valid Cases	117		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.14.

b. Computed only for a 2x2 table

Toxoplasmosis infection * newborn's health

Research question: Are newborns of toxoplasmosis diseased mothers also infected?

H₀: the newborns are healthy

H_a: the newborns are infected

P-value=0<0.05 implies the results are significant and we reject H₀ and accept H_a.

Crosstab

Count		health status of child		Total
		normal	infected	
toxoplasmosis infection	yes	16	37	53
	no	56	8	64
Total		72	45	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	40.233 ^a	1	.000		
Continuity Correction ^b	37.848	1	.000		
Likelihood Ratio	42.762	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	39.889	1	.000		
N of Valid Cases	117				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.38.

b. Computed only for a 2x2 table.

Toxoplasmosis infection * body weight

Research question: Is there a relation between body weight and toxoplasmosis?

H₀: there isn't any relation between body weight and toxoplasmosis

H_a: there is a correlation between body weight and toxoplasmosis

From chi-square test, p-value=0.550>0.05 thus the results aren't significant so we accept H₀ and reject H_a.

Crosstab

Count		body weight					Total
		[50-65]	[65=79]	[79-94]	[95-109]	[109-135]	
toxoplasmosis infection	yes	16	17	13	6	1	53
	no	17	26	15	3	3	64
Total		33	43	28	9	4	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.050 ^a	4	.550
Likelihood Ratio	3.101	4	.541
Linear-by-Linear Association	.014	1	.905
N of Valid Cases	117		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 1.81.

Toxoplasmosis * week of delivery**Research question: Does toxoplasmosis affect the duration of pregnancy?**

H₀: toxoplasmosis doesn't affect the duration of pregnancy

H_a: toxoplasmosis interferes with the duration of pregnancy

From chi-square test, p-value=0.102>0.05 therefore the results aren't significant and we accept H₀ and reject H_a.

Crosstab

Count		week of delivery			Total
		[30-37]	[37-40]	[40-41]	
toxoplasmosis infection	yes	7	39	7	53
	no	3	45	16	64
Total		10	84	23	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.556 ^a	2	.102
Likelihood Ratio	4.656	2	.097
Linear-by-Linear Association	4.397	1	.036
N of Valid Cases	117		

a. 1 cell (16.7%) have expected count less than 5. The minimum expected count is 4.53.

Toxoplasmosis infection * residence

Research question: Is there a difference in the prevalence of the disease among subjects living in a city vs subjects living in a village?

H₀: residence isn't related to the possibility of infection with the parasite *T.gondii*

H_a: residence affects the chances of infection by *T. gondii*

P-value=0.479>0.05 so the results are not significant and H₀ is accepted and H_a is rejected.

Crosstab

Count		residence		Total
		city	village	
toxoplasmosis infection	yes	19	34	53
	no	19	45	64
Total		38	79	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.502 ^a	1	.479		
Continuity Correction ^b	.260	1	.610		
Likelihood Ratio	.501	1	.479		
Fisher's Exact Test				.553	.305
Linear-by-Linear Association	.498	1	.481		
N of Valid Cases	117				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 17.21.

b. Computed only for a 2x2 table.

Toxoplasmosis infection * family history

Research question: Is family history a risk factor of toxoplasmosis?

H₀: the family history isn't a risk factor of toxoplasmosis

H_a: a family history of toxoplasmosis displays a correlation with the infection of the pregnant women

P-value=0.213>0.05 then the results aren't significant and H₀ is accepted and H_a is rejected.

Crosstab

Count		family history		Total
		yes	no	
toxoplasmosis infection	yes	17	36	53
	no	14	50	64
Total		31	86	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.549 ^a	1	.213		
Continuity Correction ^b	1.069	1	.301		

Likelihood Ratio	1.544	1	.214	
Fisher's Exact Test				.293 .151
Linear-by-Linear Association	1.536	1	.215	
N of Valid Cases	117			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 14.04.

b. Computed only for a 2x2 table.

Toxoplasmosis infection * rubella infection

Research question: If a pregnant woman has rubella, would that influence the infection by *T. gondii*?

H₀: there's no association between rubella infection and toxoplasmosis

H_a: rubella infection influences toxoplasmosis

P-value=0.218>0.05 thus the results are not significant so H₀ is accepted and H_a is rejected.

Crosstab

Count		rubella infection		Total
		yes	no	
toxoplasmosis infection	yes	37	16	53
	no	51	13	64
Total		88	29	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.517 ^a	1	.218		
Continuity Correction ^b	1.033	1	.309		
Likelihood Ratio	1.512	1	.219		
Fisher's Exact Test				.283	.155
Linear-by-Linear Association	1.504	1	.220		
N of Valid Cases	117				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.14.

b. Computed only for a 2x2 table.

Toxoplasmosis infection * Hepatitis B surface antigen

Research question: Is there a relation between infection with hepatitis B virus and toxoplasmosis?

H₀: HBsAg and toxoplasmosis seropositivity are independent

H_a: There is a relation between hepatitis B and toxoplasmosis

P-value=0.127>0.05 so results aren't significant hence H₀ is accepted and H_a is rejected.

Crosstab					
Count					
		Hbs Ag		Total	
		yes	no		
Toxoplasmosis infection	yes	43	10	53	
	no	44	20	64	
Total		87	30	117	
Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.331 ^a	1	.127		
Continuity Correction ^b	1.727	1	.189		
Likelihood Ratio	2.374	1	.123		
Fisher's Exact Test				.142	.094
Linear-by-Linear Association	2.311	1	.128		
N of Valid Cases		117			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.59.

b. Computed only for a 2x2 table

Toxoplasmosis infection * Hemoglobin

Research question: Is hemoglobin level correlated with the occurrence of toxoplasmosis?

H₀: Hemoglobin level doesn't show any relation with toxoplasmosis

H_a: Hb level shows a significant relation with toxoplasmosis

P-value=0.494>0.05 therefore the results aren't significant so H₀ is accepted and H_a is rejected.

Crosstab					
Count					
		Hbg		Total	
		[7-10]	[10-14]		
Toxoplasmosis infection	yes	9	44	53	
	no	8	56	64	
Total		17	100	117	
Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.469 ^a	1	.494		
Continuity Correction ^b	.177	1	.674		
Likelihood Ratio	.467	1	.495		
Fisher's Exact Test				.601	.336
Linear-by-Linear Association	.465	1	.495		
N of Valid Cases		117			

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.70.

b. Computed only for a 2x2 table.

Toxoplasmosis infection * Vitamin D3 level

Research question: Is there an association between vitamin D3 level and toxoplasmosis?

H₀: Vitamin D3 level doesn't relate to toxoplasmosis

H_a: there's a relation between vitamin D3 level and toxoplasmosis

P-value=0.37>0.05 so the results aren't significant thus H₀ is accepted and H_a is rejected.

Crosstab

Count		Vitamin D3 level		Total
		deficiency	normal	
Toxoplasmosis infection	yes	47	6	53
	no	53	11	64
Total		100	17	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact (2-sided)	Sig. (1-sided)
Pearson Chi-Square	.804 ^a	1	.370		
Continuity Correction ^b	.401	1	.527		
Likelihood Ratio	.817	1	.366		
Fisher's Exact Test				.437	.265
Linear-by-Linear Association	.797	1	.372		
N of Valid Cases	117				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.70.

b. Computed only for a 2x2 table.

Toxoplasmosis infection * TSH level

Research question: Is TSH level a parameter that relates to toxoplasmosis?

H₀: TSH level and toxoplasmosis are independent of each other

H_a: TSH level and toxoplasmosis are correlated

P-value=0.194>0.05 thus the results aren't significant and H₀ is accepted while H_a is rejected.

Crosstab

Count		TSH level		Total
		normal	deficiency	
toxoplasmosis infection	yes	53	0	53
	no	62	2	64
Total		115	2	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.685 ^a	1	.194		
Continuity Correction ^b	.338	1	.561		

Likelihood Ratio	2.442	1	.118
Fisher's Exact Test			.500 .297
Linear-by-Linear Association	1.671	1	.196
N of Valid Cases	117		

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .91.

b. Computed only for a 2x2 table.

Toxoplasmosis * gender

Research question: Does *T. gondii* infect a certain gender more than the other?

H₀: Gender doesn't affect toxoplasmosis occurrence

H_a: Toxoplasmosis is gender biased

P-value=0.691>0.05 so results aren't significant thus H₀ is accepted whereas H_a is rejected

Crosstab

Count		Sex of child		Total
		boy	girl	
toxoplasmosis infection	yes	35	18	53
	no	40	24	64
Total		75	42	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.158 ^a	1	.691		
Continuity Correction ^b	.041	1	.839		
Likelihood Ratio	.158	1	.691		
Fisher's Exact Test				.704	.420
Linear-by-Linear Association	.156	1	.693		
N of Valid Cases	117				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 19.03.

b. Computed only for a 2x2 table.

Toxoplasmosis * blood type

Research question: Does having a certain blood type boost the chances of toxoplasmosis?

		Count								Total
		blood type								
		A-	A+	AB-	AB+	B-	B+	O-	O+	
toxoplasmosis infection	yes	0	11	0	4	2	11	1	24	53
	no	1	20	1	8	3	9	3	19	64
Total		1	31	1	12	5	20	4	43	117

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.955 ^a	7	.434
Likelihood Ratio	7.778	7	.353
Linear-by-Linear Association	4.123	1	.042
N of Valid Cases	117		

H₀: Different blood types don't affect the likelihood of toxoplasmosis

H_a: Blood types could influence the possibility of toxoplasmosis

P-value=0.434>0.05 so results aren't significant which implies that H₀ is accepted and H_a is rejected.

Crosstab

		FBS			Total
		[65-80]	[80-120]	[120-180]	
Toxoplasmosis infection	yes	17	31	5	53
	no	11	47	6	64
Total		28	78	11	117

a. 8 cells (50.0%) have expected count less than 5. The minimum expected count is .45.

Toxoplasmosis * Fasting blood sugar

Research question: Is fasting blood sugar a parameter related to toxoplasmosis?

H₀: there's no link between FBS and toxoplasmosis

H_a: there's a connection between FBS and toxoplasmosis

P-value=0.161>0.05 hence the results aren't significant so H₀ is accepted and H_a is rejected.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.657 ^a	2	.161
Likelihood Ratio	3.657	2	.161
Linear-by-Linear Association	2.024	1	.155
N of Valid Cases	117		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.98.

4. Discussion

The significant results in our studied sample: age, having pets, mode of delivery and the health status of the fetus were congruous with previous studies in different populations. In our findings, the older the pregnant women, the more the observed cases of toxoplasmosis. Also, the infection was shown to be related to owning pets. As for the mode of delivery, a great percentage of pregnant women having toxoplasmosis gave birth through a caesarean section. Out of these infected women, a significant number delivered babies infected with *T. gondii*. The rest of the studied variables weren't significant for our chosen population although some of these results aren't consistent with previous studies in other populations. For example, residence was a significant parameter in other studies while in ours it wasn't due to the fact that some Lebanese villages are turning into city like areas with limited gardening and farming. In addition, we investigated some biological and hormonal parameters that are important in any pregnancy but none showed any correlation with toxoplasmosis infection and transmission.

5. Conclusion

Testing for *Toxoplasma gondii* before pregnancy via a blood test is a must since there is a chance for newborns to get infected. However, if being positively diagnosed with toxoplasmosis after pregnancy, several medications can be used for treatments. Precaution measurements are a necessity to avoid future infections during pregnancy. In Chouf and Saida, infection of pregnant women with *T.gondii* is correlated to their age and exposure to pets. The infection of the pregnant ladies leads to caesarean section delivery and to toxoplasmosis infected newborns.

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Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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