The Correlation between Meat Consumption with the Risk of Contracting Toxoplasma Gondii with the Occurrence of Patients with Toxoplasmosis in Bogor Aquatreat Clinic, Indonesia

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Abstract

Background : Toxoplasmosis is a zoonotic disease originated from parasite of Toxoplasma gondii. The purpose of this research is to analyze The Correlation between Meat Consumption with the risk of contracting *Toxoplasma gondii* with the occurrence of Patients with Toxoplasmosis in Bogor Aquatreat Clinic, Indonesia.

Method : In this research, case control research design is used with a quantitative approach. This research is an observational research using data of medical record in Bogor Aquatreat clinic Indonesia by selecting the positive serological test results of Toxoplasmosis (IgG) for the case group and selecting the negative serological test results of Toxoplasmosis (IgG) for the control group. Afterwards, interviews of the case and the control groups were done by filling out the questionnaire (GForm). The taken data is the data of patients who visited in 2019 with a total of 286 patients. The data that are willing to be used as a sample are the data of 108 patients. The data analysis techniques which used in this research were phased, those are: univariate, bivariate and multivariate analyzes which computerized by using a statistical program (SPSS Statistics 25).

Result: The results of this research showed that the proportion of the respondents who consumed meat are risked in the toxoplasmosis case group was 28 (51.9%) higher than the respondents who were not accustomed to consume meat are risked in the case of toxoplasmosis was 26 (48.1%). Logistic regression analysis of the final model showed a significant correlation between meat consumption at risk with the incidence of toxoplasmosis with OR 4.66 (95% CI: 1.87-11.59; p-value: 0.001), thus in the case group who consumed meat are at risk of contracting *Toxoplasma gondii* was 4.66 higher than the control group after being controlled by sex variables.

Conclusion: The correlation between meat consumption at risk with the incidence of toxoplasmosis in the case group who consumed meat are at risk of contracting *Toxoplasma gondii* was 4.66 higher than the control group after being controlled by sex variable.

Keywords*: Toxoplasma gondii, Toxoplasmosis, zoonosis, meat, case control*

Introduction

Toxoplasmosis is a zoonotic disease originated from parasite Toxoplasma gondii. Toxoplasmosis is also one of the five neglected parasitic infections, whereas the disease has significant economic and health impact as it reduces reproductive capacity, impaired growth, and fertility, including pregnant women who experience spontaneous abortion and fetal abnormalities (hydrocephalus, chorioretinitis, intracranial calcification, mental retardation), brain and eyes neurological disorders.[1-4] Toxoplasmosis can cause Alzheimer's disease as its long-term effect.[5]

Based on the Public Health Agency of Canada in 2011, Toxoplasma gondii infection is estimated 15-18% in adults worldwide.[6] The prevalence of Toxoplasmosis in China is 8.2%, France 61.0%, Brazil

84.5%, United States 38.0%, and India 24.0%.[7] In Indonesia, the prevalence of Toxoplasmosis infection based on serological test reaches 2-51%.[8] In 2015, ISIKHNAS stated the prevalence of Toxoplasma infection in Indonesia is about 43-88%.[9] The prevalence of toxoplasmosis in Indonesia increased due to poor environmental sanitation and many sources of transmission.[10 11]

WHO states that toxoplasmosis is a food-borne disease caused by parasitic infection of Toxoplasmosis gondii which contaminates food through animals and plants.[12] The factors of Toxoplasma infection to human occur through meat or vegetable at-risk consumption, cat fecal contamination in water and soil, blood transfusion, organ transplantation, and transmission during pregnancy.[1] Meat at-risk is the meat consumed in a half-cooked or raw that increase the risk of being contaminated by Toxoplasma gondii due to not cooked properly. A study in Bali shows that the risk factors that have a significant relationship in seroprevalence of toxoplasmosis in female consumed undercooked pork meat is 29.07 times higher compared to cooked pork (OR= 29.07), and undercooked chicken meat consumption has higher risk 8.23 times than cooked meat (OR=8.231). A study in Central Java mentioned that half-cooked meat consumption has a higher risk of 0.85 times compared to those who have never eaten undercooked meat (OR=0.85).[13]

Methods

In this research, case control research design is conducted with a quantitative approach. This research is an observational research using data of medical record in Bogor Aquatreat clinic by selecting the positive serological test results of Toxoplasmosis (IgG) for the case group and selecting the negative serological test results of Toxoplasmosis (IgG) for the control group. Toxoplasmosis diagnosis enforcement is confirmed through serum (IgG) laboratory tests data using Enzyme-Linked Immunosorbent Assay (ELISA) method. Data on age and sex were obtained from patient data. Other data for variables were obtained from interviews using questionnaires (GForm).

Data were collected and processed from March to June 2020. The patients visiting during 2019 are 286 in total with 108 patients were willing to be interviewed using questionnaires (Gform) and met with the inclusion criteria.

Inclusion criteria: have complete data according to variables to be studied. Exclusion criteria: patients who are not willing to be interviewed/fill in the questionnaire and do not complete the answers in accordance with the variables studied. collected data were cleared and checked to ensure the correct data were received.

The dependent variable in this study is Toxoplasmosis and the independent variable is at-risk meat consumption behavior. The covariate variables of this study are age, gender, pet ownership, environmental hygiene, history of blood transfusion and history of flooding.

The data were analyzed gradually in univariate, bivariate, stratification, and multivariate analysis using statistical program (SPSS Statistics 25).

Results

There are 108 respondents from data Bogor Aquatreat Clinic patients being analyzed in this study. Table 1. shows the respondent proportion of at-risk meat consumption behavior in the toxoplasmosis case is 28 respondents (51,8%), higher than those who never consume at-risk meat that is 26 respondents (48,1%). Table 2. is the proportion of the respondent age shows most of the respondents' age is 20-40 (81,5%) and respondents who raising pet is 29 (53,7%). Table 3. Bivariate analysis result shows the behavior of at-risk meat consumption in case group is 28 (51,9%) higher than control group which is 12 (22,2%). While in the respondent in case group that doesn't use to consume at-risk meat is 26 (48,1%) compared to control group 42 (77,8%). Table 4. indicates the relation between pet ownership as covariate variables and Toxoplasmosis cases is statistically significant with OR=2,76 (95% CI:1,25-6,08) p-value 0,019. Table 5 shows the at-risk meat consumption behavior as the main independent variable and 2 covariate variables are gender and pet ownership that analyzed in multivariate method. Based on the confounding analysis in table 6, the behavior of at-risk meat consumption in toxoplasmosis case shows OR=4,66, and the difference between crude and adjusted OR is 8,12% or <10%. Pet ownership is not confounding variable. Gender variable is taken out in the model and the result of at-risk meat consumption behavior and

toxoplasmosis analysis shows OR=3,77 and the difference between crude and adjusted OR is 19,09% or >10%. Gender as a confounding variable has to be included in the model. Table 7. The logistic regression test as final model shows the significant relation between at-risk meat consumption and Toxoplasmosis case with OR=4,66 (95% CI:1,87-11,59; p-value: 0,001).

Table 1. Frequency Distribution of Variables with Toxoplasmosis

Variables	Toxoplasmosis		Total
	Case	Control	n (%)
	54 (100)	**54 (100)**	**108 (100)**
At-risk Meat Consumption			
Yes	28 (51,9)	12 (22,2)	40 (37,0)
No	26 (48,1)	42 (77,8)	68 (63,0)
Gender			
Male	18 (33,3)	34 (63,0)	52 (48,2)
Female	36 (66,7)	20 (37,0)	56 (51,8)
Age			
25-40	44 (81,5)	47 (87,0)	91 (84,26)
< 25 and >40	10 (18,5)	7 (13,0)	17(15,74)
Education			
Low (≤ Highschool)	6 (11,1)	7 (13,0)	13 (12,03)
High (> Highschool)	48 (88,9)	47 (87,0)	95 (87,97)
Job			
At risk	2 (3,7)	2 (3,7)	4 (3,71)
No risk	52 (96,3)	52 (96,3)	104 (96,29)
Pet ownership			
Yes	29 (53,7)	16 (29,6)	45 (41,67)
No	25 (46,3)	38 (70,4)	63 (58,33)
House hygiene			
Not clean	6 (11,1)	4 (7,4)	10 (9,26)
Clean	48 (88,9)	50 (92,6)	98 (90,74)
Flood History			
Yes	11 (20,4)	10 (18,5)	21 (19,44)
No	43 (79,6)	44 (81,5)	87 (80,56)
Blood transfusion history			
Yes	2 (3,7)	3 (5,6)	5 (4,63)
No	52 (96,3)	51 (94,4)	103 (95,37)

Table 2. Bivariate Analysis of Variables with Toxoplasmosis

Variable	Toxoplasmosis				Total	OR	95% CI	p-value
	Case		Control					
	n	%	n	%				
At-Risk Meat Consumption								
Yes	28	51,9	12	22,2	40 (37,0)	3,77	1,64-8,68	0,003
No	26	48,1	42	77,8	68 (63,0)			
Gender								
Male	18	33,3	34	63,0	52 (48,1)	0,29	0,13-0,65	0,004*
Female	36	66,7	20	37,0	56 (51,9)			
Age								
25-40	44	81,5	47	87,0	91 (84,3)	0,66	0,23-1,87	0,597
< 25 and >40	10	18,5	7	13,0	17 (15,7)			
Education								
Low (≤ Highschool)	6	11,1	7	13,0	13 (12,0)	0,84	0,26-2,68	1,000
High (> Highschool)	48	88,9	47	87,0	95 (88,0)			
Job								
At risk	2	3,7	2	3,7	4 (3,7)	1,00	0,14-7,37	1,000
No risk	52	96,3	52	96,3	104 (96,3)			
Pet ownership								
Yes	29	53,7	16	29,6	45 (41,7)	2,76	1,25-6,08	0,019*
No	25	46,3	38	70,4	63 (58,3)			
House hygiene								
Not clean	6	11,1	4	7,4	10 (9,3)	1,56	0,42-5,88	0,742
Clean	48	88,9	50	92,6	98 (90,7)			
Flood history								
Yes	11	20,4	10	18,5	21 (19,4)	1,13	0,43-2,92	1,000
No	43	79,6	44	81,5	87 (80,6)			

Cont... **Table 2. Bivariate Analysis of Variables with Toxoplasmosis**

Blood transfusion history								
Yes	2	3,7	3	5,6	5 (4,6)	0,65	0,11-4,08	1,000
No	51	96,3	51	94,4	103 (95,4)			

* = *multivariate candidate*

Table 3. Full Model Multivariate Analysis of The Correlation between At-risk Meat Consumption with Toxoplasmosis

Variable	OR	95%CI		p-value
		Lower	Upper	
At-risk meat consumption	4,31	1,71	10,88	0,002
Gender	0,22	0,09	0,54	0,001
Pet ownership	2,86	1,19	6,93	0,020

Table 4. Confounding Analysis Result of The Correlation between At-risk Meat Consumption with Toxoplasmosis

Model	OR	95%CI		ΔOR (%)	Adj.
		Lower	Upper		
Model 1 Full Model*	4,31	1,71	10,88	-	-
Model 2 Without pet ownership	4,66	1,87	11,59	8,12	Not Confounding
Model 3 Gender	3,77	1,64	8,68	19,09	Confounding

* at risk meat consumption behavior+pet ownership+gender

Table 5. Final Result Multivariate Analysis Model

Variable	B	SE	OR	95% CI	p-value
At-risk meat consumption	1,539	0,465	4,66	1,87-11,59	0,001
Gender	-1,434	0,443	0,23	0,10-0,57	0,001

B=*Coefficients Beta*, SE= *Standard Error*, OR=*Odds Ratio*, CI=*Confidence Interval*

Discussion

Based on the case-control study on Aquatreat Bogor Clinic, we evaluated the relation between undercook meat consumption behavior and Toxoplasmosis case has resulted OR 3,77 (95% CI: 1,64-8,68; p-value 0,003) in bivariate analysis. It shows statisticaly significant relation between at-risk meat consumption behavior with Toxoplasmosis in case group has risk 3,77 times higher to have Toxoplasmosis compared to control group. The final result in multivariate analysis that analyzed the relation between undercook meat consumption behavior and Toxoplasmosis case controlled by gender has OR=4,66 (95% CI: 1,87-11,59; p-value: 0,001) which means the behavior of at-risk meat consumption in case group has risk 4,66 times higher to have Toxoplasmosis compared to control group. This corresponds with the study from Jimma University, Ethiopia, which stated the meat consumption behavior has OR = 5,57 (95% CI: 2.82–11.68; p-value; 0,000) and the adjusted AOR 5.1 (95% CI:2.82–11.68; p-value;0,001). [14] In Semarang, Indonesia, the proportion of at-risk meat consumption behavior (raw or undercook) in the case group is 60,7% and 21,4% in the control group. The proportion of respondents who do not use to eat undercook or raw meat is 39,3% in the case group and 78,6% in the control group with OR= 5,667% (95% CI = 1,743-18,423: p=0,003).[11] In Bali, the risk factor that has significant relation between seroprevalence Toxoplasmosis in female and the consumption of undercooked pork has risk 29,07 times higher compared to well-cooked pork (OR=29,07), the consumption of undercooked chicken has risk 8,23 times compared to well-cooked chicken (OR=8,231).[15] It indicates the low hygiene of the meat and consumption of half-cooked meat has risk to lead *Toxoplasma gondii* through oocyst which pollute the meat. In this study, gender included as variable that affect the correlation between at-risk meat consumption behavior with the Toxoplasmosis occurrence. The biological difference affects the body response. Research states that female have risk 0,9 times to have Toxoplasmosis than male. The prevalence among female is 66,85% and 63,97% are male.[16] Study in Minahasa shows number of seropositive Toxoplasma occurred in female 59,1%.[11] Other research in Sharjah, UAE purposed to find the correlation between the toxoplasmosis prevalence with hormone levels related to gender (progesterone, estradiol, and testosterone). Serologist test shows toxoplasmosis infection in human by hormone that inducted the anti-parasite function as immunity. The study has stated that gender-related hormones affect directly the immunologist functions.[17] Therefore, this study shows the correlation between meat consumption with the risk of contracting *Toxoplasma gondii* with the toxoplasmosis affected by gender in the case group compared to the control group.

Conclusions

The logistic regression test as final model shows the significant relation between at-risk meat consumption and Toxoplasmosis case with OR=4,66 (95% CI:1,87-11,59; p-value: 0,001) which means the behavior of undercooked meat consumption in case group has risk 4,66 times higher to have Toxoplasmosis compared to control group. Based on the study result, Toxoplasmosis can be prevented through hygiene improvement and promote to consume well-cooked meat. We also recommend researching about the other food variables that have risk to be polluted by *Toxoplasma gondii* oocysts such as vegetable and milk. We also recommend expanding the population of the study.

Ethical Considerations: This study was approved by The Research and Community Engagement Ethical Committee Faculty of Public Health Universitas Indonesia (Ket-380/UN2.F10.D11/PPM.00.02/2020).

Competing Interests: None declared

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