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RESEARCH ARTICLE

Comparison of *Toxoplasma gondii* counts in chicken and duck brain samples sold at Keputran Market, Surabaya

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Abstract

Toxoplasmosis is a zoonotic disease caused by the parasite *Toxoplasma gondii*, which is transmitted through cats as definitive hosts and also infect poultry. This occurs because poultry ingest food contaminated with *oocysts* of *Toxoplasma gondii*. The most commonly consumed poultry are chicken and duck. This study aims to compare the counts of *Toxoplasma gondii* in chicken and duck brain samples sold at Keputran Market, Surabaya. This research is an analytical observational study with a *cross-sectional* approach, using direct preparation and flotation methods as research instruments. The samples in this study consisted of 24 chicken brain samples and 24 duck brain samples. The statistical analysis used was the *Chi-Square* test. The results showed that 16.7% (8 samples) of the chicken brain samples were positive and 33.3% (16 samples) were negative for *Toxoplasma gondii*. Meanwhile, 12.5% (6 samples) of the duck brain samples were positive and 37.5% (18 samples) were negative for *Toxoplasma gondii*. The data were analyzed using the *Chi-Square* test, resulting in a value of 0.752 ($\geq$0.05), indicating that there is no significant difference in the presence of *Toxoplasma gondii* between the chicken and duck brain samples sold at Keputran Market, Surabaya.

Keywords: Chicken, Duck, Comparison, *Toxoplasma gondii*.

INTRODUCTION

Toxoplasmosis is a common disease in tropical countries. An example is Indonesia, which still faces several problems such as high population density, limited health services, low awareness of personal hygiene, and a relatively high population growth rate. Toxoplasmosis is caused by infecion with the obligate intracellular parasite Toxoplasma gondii and is a zoonotic disease, it can contaminate animals and be transmitted to humans (Rouatbi et al., 2019). In most human populations, the seroprevalence of the parasite increases with age and varies by gender. Oocysts can also persist longer in humid environments and low-altitude areas. Transmission of *Toxoplasma gondii* can occur through food, such as undercooked meat, as well as from gardening without gloves due to contact with soil or animal feces. Additionally, unhygienic vegetables and fruits, as well as untreated drinking water,

can also be sources of transmission (Laboudi et al., 2020). In East Africa, livestock farming, poor environmental hygiene, and poverty remain significant issues (Mose et al., 2020). This situation may arise because the community lacks knowledge about the role of pets in the transmission of *Toxoplasma gondii*.

In a study conducted by Daryanto et al., 2023, it was found that the seroprevalence of Toxoplasma gondii antibodies in chickens from traditional farms was 95.8% from 24 tested chicken sera, whereas the seroprevalence in chickens from modern farms was 8.3% from 24 tested chicken sera. According to research by Avin and Melaniani, 2018, Toxoplasma gondii infection was detected in 2 chicken brain samples, while 28 chicken brain samples were found negative for Toxoplasma gondii cysts.

Based on the above description, further reseacrh is needed to verify the presence of *Toxoplasma gondii* using chicken and duck brain samples with the direct preparation method and the flotation method. The objective of this study are to compare the counts of *Toxoplasma gondii* in chicken and duck brain samples and to determine the presence of *Toxoplasma gondii* contamination in chicken and duck brains at Keputran Market, Surabaya.

MATERIALS AND METHODS

Materials

The materials used in this study are chicken brain samples, duck brain samples, NaCl, and distilled water.

Procedure Data Collection

Based on the data collection procedure, primary data is obtained directly from the research. In the pre-analytical phase, samples are collected. In the analytical phase, *Toxoplasma gondii* is examined using the flotation method and the direct method, then observed under a microscope at 40x and 100x magnification. In the post-analytical phase, the examinatiom results are recorded, and the data is analyzed using SPSS.

Procedure Data Analysis

In data analysis, univariate analysis is conducted to determine the comparison of positive and negative results in chicken and duck brains. Bivariate analysis is performed to compare the counts of *Toxoplasma gondii* in chicken and duck brains at Keputran Market, Surabaya, using the Chi-Square test since both are categorical (nominal) data. The significance level (α) is set at 5% or 0.05. If the p-value > 0.05, the counts between chicken and duck brains.

RESULTS AND DISCUSSION

Results of Microscopic Examination

The research results were obtained from 48 samples, consisting of 24 chicken brain samples and 24 duck brain samples sold at Keputran Market, Surabaya. The research was conducted at the Entomology Laboratory of the Health Polytechnic of the Ministry of Health, Surabaya. The 48 samples were examined for Toxoplasma gondii using direct preparation and flotation methods. The examination results are as follows:

Table 1. Microscopic examination

No	Sample Type	Sample	Direct Preparation Method		Flotation Method	
			Positive	Negative	Positive	Negative
1	Chicken Brain	I	Positive		Positive	
		II	Positive		Positive	
		III		Negative		Negative
		IV		Negative		Negative
		V		Negative		Negative
		VI		Negative		Negative
		VII		Negative		Negative
		VIII	Positive		Positive	
		IX		Negative		Negative
		X		Negative		Negative
		XI	Positive		Positive	
		XII		Negative		Negative
2	Duck Brain	I		Negative		Negative
		II		Negative		Negative
		III		Negative		Negative
		IV		Negative		Negative
		V		Negative		Negative
		VI	Positive		Positive	
		VII		Negative		Negative
		VIII	Positive		Positive	
		IX	Positive		Positive	
		X		Negative		Negative
		XI		Negative		Negative
		XII		Negative		Negative

Based on the data after microscopic examination for *Toxoplasma gondii* in chicken brains using the direct preparation method, 4 samples were found to be positive and 8 samples were negative. In the flotation method, 4 samples were found to be positive and 8 samples were negative. For the microscopic examination of *Toxoplasma gondii* in duck brains using the direct preparation method, 3 samples were positive and 9 samples were negative. In the flotation method, 3 samples were found to be positive and 9 samples were negative.

Result of Data Analysis

Table 2. *Chi-Square*Test Sample

Method	Result				Chi-Square
	Negative		Positive		
	N	%	n	%	
Chiken Brain	16	33.3	8	16.7	0.752
Duck Brain	18	37.5	6	12.5	
Total	34	70.8	14	29.2	

Based on the table, the results show that out of the chicken brain samples, 8 samples (16.7%) were positive for Toxoplasma gondii and 16 samples (33.3%) were negative. In contrast, for duck brains, 6 samples (12.7%) were positive and 18 samples (37.5%) were negative. The *Chi-Square* test yielded a result of 0.752 ($\geq$0.05), indicating that there is no significant difference between *Toxoplasma gondii* counts in chicken and duck brains.

Result of *Chi-Square*

Table 3. *Chi-Square* Analysis on Test Methods

Method	Result				Chi-Square
	Negative		Positive		
	N	%	n	%	
Direct Preparation	17	35.4	7	14.6	1.000
Floting	17	35.4	7	14.6	
Total	34	70.8	14	29.2	

Based on the table, it's shown that the direct preparation method and the flotation method yielded different results, with 7 samples (14.6%) testing positive and 17 samples (35.4%) testing negative using the direct preparation method. The Chi-Square test result was 1.000 ($\geq$0.05), indicating that there is no significant difference between *Toxoplasma gondii* detection using the direct preparation method and the flotation method.

Discussion

The study conducted is an analytical observational study using chicken and duck brain samples examined by two methods: the flotation method and the direct preparation method, to detect *Toxoplasma gondii* contamination. The examination results showed that 33.3% of the chicken brain samples and 37.5% of the duck brain samples were negative, indicating that these samples were not infected with *Toxoplasma gondii* cysts. This may be due to the clean management practices for chickens and ducks, reducing the presence of vectors like flies that could carry *Toxoplasma gondii* oocysts and contaminate the housing or feeding areas, thereby preventing infection. Clean housing conditions minimize the risk of infection since vectors and animals that carry *Toxoplasma gondii*, such as flies, rodents, and stray cats, are less likely to be present in a clean environment (Soedarto, 2012).

The positive results were found in 16.7% of chicken brain samples and 12.5% of duck brain samples, suggesting that some chickens and ducks might be infected with *Toxoplasma gondii*. The positive samples likely indicate that the management and cleanliness of the chicken and duck housing were inadequate, with poor sanitation and available sources of contamination contributing to the higher infection rates of *Toxoplasma gondii* (Wulandari, 2017). In the housing where positive samples were found, there were many cats in the vicinity. This presence of cats suggests that they might be infected with *Toxoplasma gondii* and could potentially transmit the parasite to the chickens and ducks.

Cats that roam freely and eat raw meat are at risk of infection if they consume food containing trophozoites. When cats ingest oocysts, they become infected, and these oocysts can be excreted in their feces, contaminating the environment, food sources such as meat, and potentially infecting humans. Positive test results can occur when flies, which can be vectors for *Toxoplasma gondii*, come into contact with poultry housing and feeding areas. These flies can carry oocysts from cat feces and contaminate the feed, leading to the animals eating infected food. Oocysts can remain infectious for up to a year in warm, humid conditions, and can stay infectious in water for six months (Soedarto, 2012).

The life cycle of *Toxoplasma gondii* plays a crucial role in how animals get infected and subsequently transmit the infection to humans. This cycle comprises two phases: the sexual phase, which occurs exclusively in cats and results in the production of oocysts excreted in their feces, and the asexual phase, which takes place in warm-blooded animals, including cats (within the epithelial cells of the small intestine), rodents, humans, and birds. Asexual reproduction occurs in intermediate hosts (Harryanto et al., 2014). Cats, being the definitive hosts, allow Toxoplasma to complete its lifecycle. Oocysts released in cat feces mature into infectious forms within 2-3 days at an ideal temperature of about 24°C. These oocysts can readily contaminate humans through direct soil contact, such as gardening, and can also infect poultry that might ingest feed tainted with oocysts from cat feces.

The potential for transmission is also due to the lack of public knowledge. Public awareness plays a significant role in the spread of Toxoplasmosis. Individuals with limited knowledge about the origins of Toxoplasmosis may experience higher rates of the disease. Lack of awareness can lead to unhygienic and unhealthy behaviors, which in turn contribute to health issues, particularly the transmission of Toxoplasmosis (Prawita and Kardiwinata, 2013).

Comparison of *Toxoplasma gondii* Counts in Chicken and Duck Brain Samples Sold at Keputran Market, Surabaya

Based on this study, descriptive analysis revealed that 33.3% of chicken brain samples and 37.5% of duck brain samples were negative for Toxoplasma gondii. For positive samples, 16.7% of chicken brains and 12.5% of duck brains tested positive. The average *Toxoplasma gondii* result for chicken and duck brain samples was 0.752, indicating no significant difference between *Toxoplasma gondii* levels in chicken and duck brains. This lack of significant difference may be due to the relatively clean environment of the market, leading to a higher proportion of negative results compared to positive ones. This finding contrasts with the study by Daryanto et al., 2023, which reported a significant difference. Factors such as the distance between the sample collection sites and the research location could contribute to these discrepancies.

The *Chi-Square* test revealed that among chicken brain samples, 8 (16.7%) tested positive for *Toxoplasma gondii*, while 16 samples (33.3%) were negative. For duck brain samples, 6 (12.7%) tested positive and 18 samples (37.5%) were negative. The Chi-Square result of 0.752 ($\geq$0.05) indicates no significant difference between *Toxoplasma gondii* levels in chicken and duck brains. This finding contradicts the study by Daryanto et al., 2023, which reported a significant difference. Factors such as the distance between sample collection sites and research locations might contribute to this discrepancy. For the direct microscopy method, 7 samples (14.6%) tested positive and 17 (35.4%) were negative. Similarly, the flotation method also showed 7 positive samples (14.6%) and 17 negative samples (35.4%). These results suggest that the direct microscopy method and the flotation method produced different positive and negative outcomes. However, the *Chi-Square* test for these methods yielded a result of 1.000 ($\geq$0.05), indicating no significant difference between the *Toxoplasma gondii* detection results using direct microscopy and flotation methods.

CONCLUSIONS

Based on the study results, it can be concluded that there is contamination of *Toxoplasma gondii* in both chicken and duck brain samples sold at Keputran Market, Surabaya. Among the chicken brain samples, 8 (16.7%) were positive and 16 (33.3%) were negative. For duck brain samples, 6 (12.7%) were positive and 18 (37.5%) were negative. There was no significant difference in the contamination levels between chicken and duck brains, with a p-value > 0.05. Additionally, no significant difference was observed between the direct microscopy method and the flotation method in detecting *Toxoplasma gondii* in both chicken and duck brain samples.

Author contributions

Yuliana Dwi Kurnia Cahyani: Conceptualization, writing draft, writing review, formal analysis and editing ; Yauwan Tobing Lukiyono, Ersalina Nidianti, Muhammad Afwan Romdloni: formal analysis and Data curation.

Conflict of Interest

There is no conflict of interest in this study.

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Data availability

Data related to the findings of this study are available at the corresponding author.

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