Prevalence Rate and Infection Degree of Helminthiasis on Pigeon (Columbia Livia Domestica) in North Surabaya

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Abstract

Pigeon meat is an alternative option to other poultry meat such as chickens. As pigeons are easy to keep and quickly reproduce. Improper hygiene practices are a strong factor in helminthiasis transmission. This study aims to know the prevalence and degree of infection of helminthiasis in North Surabaya. Seventy samples taken from pigeon butchers in North Surabaya from September to November 2022. Dissection of pigeon done for prevalence rate count and modified McMaster method used to count degree of infection. The result shown that 70% of samples had positive worm infection. Types of worms found were R. cesticillus (55.7%), Ascaridia sp. (25.7%), Capillaria sp. (14.2%), Echinostoma sp. (2.8%) and Heterakis sp. (1.4%). Qualitative examination shown helminthiasis was more prevalent in adult pigeon than in squab, but analysis with Chi-square test shown no significant association between helminthiasis infection and age of the pigeons (P>0.05). Likely because of direct contact and interaction between squab and adult.

Quantitative examination with McMaster method shown degree of infection of single Ascaridia infection in adult pigeons was 340 EPG while in Capillaria sp. was 287.5 EPG and 150 EPG in Heterakis. All of them considered mild infection according to Soulsby (1986). Thus, proper loft and feed hygiene should applied to prevent more transmission.

Keywords: Pigeons, Helminthiasis, Prevalence, Degree of infection

Introduction

Pigeon is one of the most common birds found in Indonesia, either for consumption or race bird. Young pigeon meat, also known as squab, has a striking appearance compared to other poultry meat. The red colour with soft meat fibre gives a unique taste (Samudera et al., 2016). Generally, pigeon breeder use traditional method (extensive method), in which the birds are kept using traditional lofts. In Java, Pigeon lofts called “Pagupon” and birds fed with grains, leftover rice and rice or corn bran. To meet nutritional needs, the birds will forage around the environment. With Intensive farming method, the pigeons kept in standard lofts with all nutritional needs provided by the breeder (Hamid et al., 2015).

Helminths infections often lead to reduced egg production and development, growth retardation, emaciation, lethargy and diarrhea (Rahman et al., 2019; Al-Quraishy et al., 2019; Aldamigh et al., 2022). The infection of domestic pigeons with helminth parasites can lead to an increase in mortality and has severe economic consequences (Aldamigh et al., 2022). Helminthiasis reports on North Surabaya is important, as many restaurants and food vendors in Surabaya butcher and purchase pigeons from this area. As many helminths in pigeons also infect other poultry and sometimes humans (Winarti and Widyastuti, 2015).

To obtain accurate information in regard to the severity of an infection, egg-counting methods have been devised in order to determine the number of eggs per gram of faeces (Soulsby, 1986). It could be used to determine the efficacy of drug treatment (Zajac and Conboy, 2012).

This research aims to identify and determine prevalence rate and degree of infection of helminthiasis in meat pigeons in North Surabaya. The results of this research could be used as reference for disease control and husbandry standard evaluation in meat pigeon.

Research Methods

Sample and Sample Size

Sample intestine examination was conducted in Veterinary Parasitology Laboratory, Faculty of Veterinary Medicine, Universitas Airlangga from September to November of 2022. Seventy pigeon intestines taken from pigeon butchers who collected them from traditional breeders around
Kenjeran, Pabean and Petekan sub-districts in North Surabaya.

**Intestine Dissection**

Pigeon intestine taken and separated from other organs into a petri dish. Longitudinal incision then made along the intestine and the content exposed. Worms found in the lumen then extracted and moved to separate Petri dish filled with NaCl solution to clean the worm off of debris. Worms then counted and identified through magnifying glass. Smaller worms found in intestine petri dish extracted under dissecting microscope. The identification based on the identification key by Soulsby (1982), Koesdarto et al. (2017) and Mumpuni et al. (2017). Helminths then preserved in alcohol glycerine 5% to be stained with carmine. Sample was determined as positive when there is at least one organism of a species detected in the intestinal lumen. The result from this exam used to determine prevalence rate.

Two grams of faeces from the intestinal lumen then collected in a plastic container for floatation and McMaster examination.

**Native Faecal Exam**

Two drops of aqueoust dropped on object glass. Faecal sample taken and homogenized with the aqueoust using sticks. Sample then covered with cover glass and examined under microscope with 40x magnifications. Egg identification based on Foreyt (2001), Mumpuni et al. (2017) and Soulsby (1986).

**McMaster Exam**

The faeces mixed with 28 ml of aqueoust, mixed and homogenized well. The mixture then filtered using sieve and poured into 15 ml centrifuge tube and run through centrifuge with speed of 1500 rpm for 5 minutes. Supernatant then discarded. Flotation solution added until half of the tube, then homogenized well. More flotation fluid then added until 15 ml and homogenized further. The suspension then shaken and taken through a pipette to fill the camera of McMaster slide, being careful not to form air bubbles. Take another aliquot for the other camer.

**Flotation Exam**

The remained suspension then used for flotation method. More flotation solution then added with pipette until there was a reverse meniscus on top of the vial and place a coverslip on top of the fluid. The flotation then left standing for 5-10 minutes to allow the eggs to float, the coverslip then removed and placed on object glass to be examined under microscope with 40-100x magnifier (Zajac and Conboy, 2012; Permatasari et al., 2020).

**Acetic-Carmine Staining**

The worm submerged in alcohol glycerine 5% for 24 hours to preserve and soften the cuticle. The worm then submerged into alcohol 70% for 5 minutes. The worm then moved into diluted Carmine solution and submerged for more or less 8 hours. The worm then moved to acid alcohol (alcohol 70% + HCl) for 2 minutes and then submerged in basic alcohol (alcohol 70% + NaHCO₃) for 20 minutes. The worm then put into gradual dehydration through alcohol 70%, alcohol 85% and alcohol 95% for 5 minutes each. Next process is mounting the worm in Hung I solution for 20 minutes then glued with Hung II solution to keep object glass, sample and cover glass together. The sample dried in incubator in 37°C for one hour or more.

**Data Analysis**

Calculation for Prevalence rate and Degree of Infection based on McMaster method and research data presented descriptively in the form of tables and graph. Chi-square test used to analyse the association between helminthiasis infection and age of the pigeon. The computer program used is IB SPSS Statistic v22.

**Results and Discussion**

Intestine examination of 70 pigeons revealed 49 positive samples or 70% helminthiasis infection. 24 out of 33 (72.7%) of samples of adult pigeons were infected with helminthiasis while 25 out of 37 (67.5%) squab samples were infected with helminthiasis (Table 1). Statistical analysis showed that there is no significant association found between helminthiasis infection and age of the pigeons (p > 0.05). This is likely because squab and adult pigeons are often in direct contact and interaction with each other, especially when adults are feeding or brooding nestlings, thus infective eggs transmit easily between them. This result was in accordance with the study done by Sivajothi and Sudhakara (2015).

<table>
<thead>
<tr>
<th>Age</th>
<th>Helminthiasis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Squab</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>Adult</td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>21</td>
</tr>
</tbody>
</table>

Table 1. Prevalence of Helminthiasis
Types of worms found were Raillietina cesticillus (55.7%), Ascaridia sp. (25.7%), Capillaria sp. (14.2%), Echinostoma sp. (2.8%) and Heterakis gallinarum (1.4%). Single infection of Ascaridia sp. is 8.5%, while R. cesticillus is 35.7%. Mixed infection with different combination of worm species made up 30.6% of positive samples. Multiple infection recorded, were R. cesticillus, Ascaridia sp. and Capillaria sp. (7.1%); R. cesticillus, Ascaridia sp. and H. gallinarum (1.4%); R. cesticillus and Capillaria sp. (4.2%); R. cesticillus and Ascaridia sp. (7.1%); Ascaridia sp. and Capillaria sp. (1.4%). List of helminthiasis infection could be seen in Table 2.

In this research, the prevalence rate of helminthiasis in pigeon is 70% which higher than previous research result by Muqorobin et al. (2017), but lower than result by Ashfiyah et al. (2022) in Tuban. In comparison, report by Sivajothi and Sudhakara (2015) in Adhra Pradesh, India and Umaru et al. (2017) in Taraba State, Nigeria shown similar result of 72.7% and 78.3% respectively. Despite the similarity of overall high helminth prevalence, distribution of helminth species was different. The reason for this difference most likely influenced by geographic and environmental condition, number of pigeons examined and season during research, management practices as well as intermediate hosts availability and distribution.

High prevalence rate of worms can be attributed to the lack of hygiene management in pigeon rearing which raised the chance of infested droppings to be ingested and transmitted (Al-Quraishy et al., 2019). As many farmers in North Surabaya likely neglected loft cleaning and medical treatment to save money. Other contributing factors are the distribution and reproduction pattern of intermediate hosts. Main factor that makes this research result higher than report by Muqorobin et al. (2017) was that our research samples were mainly taken from pigeons reared with extensive and semi-intensive method which allows them to search for more food in farther area and predispose them to more infective stage of helminths (Umaru et al., 2017). While sample research by Muqorobin et al. (2017) was taken from farms using intensive and extensive method.

**Table 2. Positive Samples in Different Age Group for Each Parasite Found**

<table>
<thead>
<tr>
<th>Single Infection</th>
<th>Squab</th>
<th>Adult</th>
<th>Total</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascaridia sp.</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>8.5%</td>
</tr>
<tr>
<td>R. cesticillus</td>
<td>12</td>
<td>13</td>
<td>25</td>
<td>35.7%</td>
</tr>
<tr>
<td>Capillaria sp.</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.4%</td>
</tr>
<tr>
<td>Echinostoma sp.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

Mixed infection

| Ascaridia, R. cesticillus and Capillaria | 0     | 5     | 5     | 7.1%           |
| Ascaridia and Raillietina              | 4     | 1     | 5     | 7.1%           |
| R. cesticillus and Capillaria          | 0     | 3     | 3     | 4.2%           |
| Ascaridia and Capillaria               | 1     | 0     | 1     | 1.4%           |
| Ascaridia, R. cesticillus and H. gallinarum | 1     | 0     | 1     | 1.4%           |

Figure 1: The graph of degree of infection based on sample's age group

Out of 70 samples, 13 samples have positive egg count. Egg found are from Ascaridia, Capillaria and Heterakis species. Figure 1 is a graph showing infection degree per age group. Infection degree from squab age group shown lowest value on all worm species observed with EPG of 75 for Capillaria sp.. Highest infection degree in adult pigeons is from Ascaridia sp. with 340 EPG, followed with Capillaria sp. (330 EPG) and Heterakis sp. (150 EPG). However, all of them still
considered mild infection by Soulsby (1986) as they are below 500 EPG. Nematode parasite can cause intestinal hemorrhage, mortality, weight depression, retard-ed growth and decrease in egg production (Yabsley, 2009; Qamar et al., 2017; Rahman et al., 2019). To prevent reinfection, loft should be cleaned regularly and dried under direct sun. The feed hygiene should be checked and evaluated, and the water should be replaced daily. Formalin, povidone iodide and TH4 are effective disinfectant to inhibit embryonic development of *Ascaridia* eggs (Bessat and Amira, 2019).

As noticed, Cestode infection still have higher prevalence compared to Nematode infection, despite nematode worms not needing intermediate hosts (Al-Quraishy et al., 2019). Similar result reported by Muqorobin et al. (2017) in Surabaya. In contrast, prevalence of cestode infection were lower in study by Khezerpour and Naem (2013), Sivajothi and Sudhakara (2015), Umaru et al. (2017) and Ashfiyah et al. (2022). This result indicate possible feed contamination with insects such as ants, beetles or *Musca domestica* as the intermediate host of *Raillietina* spp. Damp and rarely cleaned lofts or nest boxes attracting flies and other cestode intermediate hosts like *Musca domestica*, termites, mini-wasps and beetles which can bring cestode eggs from other areas (Butboonchoo et al., 2016; Koesdarto et al., 2017). Warm temperature of North Surabaya and dry season also attracted these insects. Furthermore, nest boxes are also likely to swarmed by insects if they did not cleaned regularly (Ibrahim et al., 2018). As this research done during dry season, high temperature and low humidity might have affected survivability of worm eggs. According to Soulsby (1986) and Kusnanto et al. (2011) (in Ashfiyah et al., 2022), that eggs containing stage 2 larvae, are able to survive more than 3 months in a shady or protected place, but will die soon if the conditions are and weather is dry and hot.

In many samples found during examination, *Raillietina* parasites almost completely obstructing intestinal lumen. Small intestine being the site with severe infestation, causing severe enteritis, intestinal obstruction and watery feces. These pathological changes were in line with research result by Kamal et al. (2020). However, *Raillietina* eggs could not be reliably detected by flotation faecal exam (Zajac and Conboy, 2012; Mumpuni et al., 2017), thus the lack of *Raillietina* degree of infection data in this research as many *Raillietina* eggs were likely damaged or not reaching full maturity yet.

*Echinostoma* sp. only found in two samples. While *Echinostoma* known to be zoonotic, viable *Echinostoma* metacercariae infects aquatic animals, such as freshwater fish and snails as zoonotic second intermediate hosts. These metacercariae on secondary host will infect definitive host (such as humans and birds) when the secondary hosts are eaten raw (Sa$et al.$, 2018; CDC, 2019). While pigeons rarely eat invertebrates, smaller snail host might ingested by accident while the pigeons were feeding near or around water bodies, such as ponds. Pigeons infected with Echinostomiasis should be treated with appropriate dose of praziquantel orally (De Herdt and Pasmans, 2009; Motarjemi et al., 2014).

**Conclusion**

Prevalence of helminthiasis in North Surabaya is 70%. *R. cesticillus* has the highest prevalence rate in pigeons compared to other species with the percentage of 55.7%. In comparison, *Ascaridia* sp., *Capillaria* sp., *Echinostoma* sp. and *H. gallinarum* have prevalence rate of 25.7%, 14.2, 2.8% and 1.4% respectively. There was no significant association between helminthiasis infection and pigeon’s age.

Degree of infection for *Ascaridia* sp. and *Capillaria* sp. were 340 and 287.5 EPG respectively. They are considered mild infection.

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