

**ENUMERATION OF GASTROINTESTINAL HELMINTHS OF
ORGANIC CHICKENS (HUBBARD REDBRO) RAISED IN THE
INSTITUTE OF ANIMAL SCIENCE FARM,
UNIVERSITY OF THE PHILIPPINES, LOS BAÑOS, LAGUNA**

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ABSTRACT

Organic poultry farming offers benefits but faces challenges, particularly the prevalence of gastrointestinal helminths, which are closely linked to feeding practices. This study investigated the variety and frequency of helminths in Hubbard Redbro chickens reared at the Institute of Animal Science Farm, University of the Philippines Los Baños, under two organic feeding strategies. Ten (10) chickens were randomly chosen from two flocks raised in different feeding treatments: one fed exclusively with organic feed from day 1 and the other at day 23 after an initial period on commercial feed. After 55 days, gastrointestinal analyses identified three predominant helminth species: *Ascaridia sp.*, *Heterakis sp.*, and *Raillietina sp.* Although the results are not statistically significant, that can be due to the small sample size. Chickens fed organic feed starting from day 1 showed higher mean intensity of infection of *Ascaridia sp.* ($p=0.12$) and *Heterakis sp.* ($p=0.34$), with both species having higher helminth populations recorded. In contrast, chickens transitioned to organic feeding later showed a higher average parasitic load of *Raillietina sp.* ($p=0.44$). Moreover, early organic feeding resulted in lower carcass weights that may reflect the effect of high parasite burden. These emphasize the need for improved parasite management strategies to enhance productivity and animal welfare in organic poultry farming.

Keywords: Feeding strategies, gastrointestinal helminths, Hubbard REDBRO chickens, organic poultry farming, parasite management

INTRODUCTION

The Philippines has emerged as a prominent consumer of chicken globally, with its strong demand attributable to factors such as affordability, availability, and culinary versatility (BAI, 2020; PSA, 2022). Against the backdrop of increasing consumer preferences for safer and healthier food options, organic poultry production has gained traction in the country. There has been a 29% increase in organic chicken production in the Philippines from 2017 to 2019 (NOAP-DA, 2020).

To be considered as organic agricultural products, it is required that these products adhere to ecological sustainability, social acceptability, commercial viability, and technical

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feasibility, such as prohibiting the use of chemical pesticides, fertilizers, and medicines (Roychowdhury *et al.*, 2013). Organic agriculture standards also mandate the use of inputs like composts, organic fertilizers, plant protection products, seeds, and feeding materials. Products must also undergo a conversion process outlined by the Bureau of Agriculture and Fisheries Standards (PNS/BAFS, 2016). For chickens, their organic designation is contingent upon their being reared in an organic manner starting 21 days after hatching.

Organic poultry production offers benefits such as improved animal welfare, reduced environmental impact, and healthier, safer poultry products. However, challenges like disease control persist (Arsi *et al.*, 2019; Quinn, 2023). It is recognized that organic poultry production entails certain challenges and trade-offs compared to conventional poultry farming. A major concern not only in organic poultry farming but to the whole poultry industry is the parasitism by gastrointestinal helminths. This is further amplified in organic chickens, wherein birds can ingest diverse foods like plant matter and insects that may carry helminth eggs. They also have access free-roam area with soil that may be infested with helminth eggs. These increase their risk of gastrointestinal parasitism. Helminth infestations can compromise animal welfare and productivity, challenging high organic farming standards (Shifaw *et al.*, 2021; Sutherland *et al.*, 2013).

Despite the growth of organic farming in the Philippines, information on the diversity and prevalence of helminths in organic chickens remains limited. With the assumption that feeding is intertwined with the development of gastrointestinal helminths in organic chickens, there is a need to study how different feeding techniques can contribute to the presence of such helminths (Shifaw *et al.*, 2023).

This study aims to determine if a difference exists in the parasitic load of chickens between day 1 and day 23 of organic feeding at the Institute of Animal Science Farm, University of the Philippines, Los Baños, Laguna. By enumerating the occurrence of gastrointestinal helminths during this period, the study seeks to identify changes in parasitic infestation over seven weeks. The findings will enhance animal welfare, ensure safe, high-quality organic poultry products, and improve overall animal health.

MATERIALS AND METHODS

Animals, Management, and Feeding

Chickens were raised at the Institute of Animal Science Farm, University of the Philippines Los Baños and had access to a free-range area for 6 hours daily and were housed in bamboo and coco lumber poultry houses at night. The free-range area and housing were previously vacated at the same time to ensure similar housing conditions. Housing and management protocols implemented in the study followed the Philippine National Standard for Free-Range Chicken (PNS/BAFS, 2018; PNS/BAFS, 2016). Newcastle Disease Vaccine was administered in an intraocular manner on the 7th day (B1B1) and 21st day (La Sota) of the study.

Ten (10) chickens were randomly selected from two flocks of chickens raised in different feeding treatments. Treatment 1 consists of 1-day-old birds which was fed exclusively organic feed with no antibiotics, supplements, or growth promoters; Treatment 2 was initially fed with commercial feed (B-Meg Integra 1000), manufactured by San Miguel Foods, Inc., from day 0 to 20 and transitioned to a mix of organic feeds from Day 21-22 before transitioning exclusively to organic feed at Day 23 this is to simulate the timing for

chickens to be considered organic when fed with organic feeds from Day 21 as per PNS/BAFS standard. Both groups had *ad libitum* access to water in both the range area and poultry housing.

The study was conducted in accordance with the Institutional Animal Care and Use Committee of the University of the Philippines, Los Baños, Laguna (approval reference number UPLB-2022-033).

Sample Collection and Helminth Identification

The chickens were humanely sacrificed after 55 days of feeding. Slaughter and carcass weight were collected. Moreover, the gastrointestinal tracts were carefully opened and scraped for further examination. The collected samples were then transported to the Laboratory of Parasitology at the Department of Veterinary Paraclinical Sciences, University of the Philippines College of Veterinary Medicine. Following the procedure set by Tanveer *et al.* (2013), gastrointestinal helminths were separated from the ingesta and intestinal mucosa by immersing the contents in sterile water. The helminths were cleaned, preserved in 10% formaldehyde, and subjected to identification. For this study, only helminths visible to the naked eye were considered, and their identification was based on morphological characteristics, observed under a compound microscope at 40x and 100x magnification. Cestodes were identified by observing key characteristics such as the segmented body, scolex with suckers and hooks for attachment, and proglottids along the body. Additionally, extra features like testes, uterine branches, or vaginal pores are further examined to determine the genus of the tapeworm (Tanveer *et al.*, 2013; Heyneman, 1996; Hauck, 2021). Nematodes are identified based on the morphological and anatomical variations including their mouths, the shape of the head, the number of annules (body segments), the stylet length, the shape of the stylet knob, the structure of the lateral fields, the presence or absence of a spermatheca, the shape of the female tail terminus, and the shape and length of the spicule and gubernaculum (Tanveer *et al.*, 2013; Bogale *et al.*, 2020).

Data Analysis

Intensity of infection was computed by counting the number of each helminth for each animal (Franceschi *et al.*, 2008). To determine if there were significant differences in the intensity of infection between 1-day-old organically fed chickens and 23-day-old organically fed chickens, data were initially checked for normality and homogeneity of variance using the Shapiro-Wilk normality test and Levene's test for homogeneity of variance, respectively. The data on slaughter and carcass weight passed the assumption tests; t-tests were used to analyze it. However, data on intensity of parasite infection failed the normality and homogeneity test, which was then analyzed using the Wilcoxon rank sum test. All significant levels were set at $p < 0.05$.

RESULTS AND DISCUSSION

The demand for organic poultry products continues to increase, making it crucial to uphold the integrity of organic production while ensuring the health and well-being of chickens by exploring innovative and sustainable rearing methods. However, one of the drawbacks of organically raised chickens is subpar feed conversion performance and the increased risk of helminths compared to commercially raised chickens. Additionally,

allowing organic chickens to freely roam outdoors introduces risks, as soil and vegetation can carry parasitic eggs, while insects in the outside environment can act as intermediate hosts, increasing the likelihood of parasitic infections (Holt, 2021). Therefore, optimizing feed efficiency and minimizing helminth load are crucial factors in ensuring the health and productivity of organic chickens.

The study focuses on comparing the presence and distribution of gastrointestinal helminths in Hubbard Redbro chickens under two different treatments. A total of 10 Hubbard Redbro chickens were randomly selected at the Institute of Animal Science Farm, University of the Philippines Los Baños, and were divided into two treatment groups, regardless of sex. These birds appeared healthy with no observable lesions, which could potentially affect the study results. Examination of all 10 samples revealed infections with various gastrointestinal helminths, comprising 2 species of nematode and 1 species of cestode. The nematode parasites recorded were 1578 *Ascaridia sp.* (94.9%) and 70 *Heterakis sp.* (4.2%). The cestode recovered was 14 *Raillietina sp.* (0.8%), although cestodes without a scolex were not included in the analysis as they cannot be identified accurately by gross morphology. The cestode was present in only one out of 5 samples in Day-1 organically fed chickens, while it was observed in 2 out of the 5 samples in Day-23 organically fed chickens.

Ascaridia sp. and *Heterakis sp.* were found in all the samples of Day-1 and Day-23 organically fed chickens. Although not statistically significant, chickens fed organic feed at 1 day old appeared to show a higher mean intensity of infection with *Ascaridia sp.* ($p=0.12$) and *Heterakis sp.* ($p=0.34$) compared to those fed organic feed at 23 days old (Table 1). Conversely, chickens fed with organic feeds only from 23 days old appeared to have a higher prevalence of infection of *Raillietina sp.*, with 2 out of the 5 samples infected compared to the 1 out of 5 samples infected in chickens fed at 1 day old. This resulted in a higher mean intensity of infection of *Raillietina sp.* ($p=0.44$) compared to those fed at 1 day old (Table 1).

Table 1. Mean intensity of parasite infection* of the gastrointestinal tract of Hubbard chicken organically fed at Day 1 and Day 23.

Parasites ^{NS}	Day 1	Day 23
<i>Ascaridia sp.</i>	271.2 $\pm$ 374.5	44.4 $\pm$ 43.79
<i>Heterakis sp.</i>	11.4 $\pm$ 15.65	2.6 $\pm$ 1.52
<i>Raillietina sp.</i>	0.6 $\pm$ 1.34	2.2 $\pm$ 3.03

* Values indicated are the average number of parasites and $\pm$ standard deviation.

NS – not significant ($p \geq 0.05$)

The high prevalence of *Ascaridia sp.* and *Heterakis sp.* is consistent with multiple studies that show this species to be the most common infection in poultry (Asumang *et al.*, 2019; Ara *et al.*, 2021; Berhe *et al.*, 2019). In a similar study by Ybañez *et al.* (2018), a high incidence of *Ascaridia sp.* (41.2%) and *Heterakis sp.* (59.3%) infections in 243 stool samples was observed in Leyte, Philippines. The high incidence of *Ascaridia sp.* and *Heterakis sp.* infection in chickens has also been reported by Berhe *et al.* (2019). Their study reported that *Heterakis gallinarum* (72.5%) and *Ascaridia galli* (68.8%) were found to be the most

dominant species in chickens raised in different management systems. Their prevalence may stem from their direct life cycles and relatively quick hatching period, which is typically 24-48 hours after ingestion and maturity at 28 - 30 days, and their resilient eggs, which can survive in the environment for extended periods of time (Hauck, 2024). In contrast, the limited presence of *Raillietina sp.* can be attributed to its reliance on an intermediate host, resulting in a significantly prolonged lifecycle that typically involves an intermediate host such as beetles and ants (CDC, 2019). This reliance introduces several challenges and limitations, such as reduced transmission efficiency and host specificity.

The type of feed given to chickens at a young age can significantly influence gut development. Differences in nutrient content, such as higher fiber content and lower digestibility in organic feeds, pose challenges in breaking down the digesta, making them less efficient in meeting the animals' nutritional needs compared to conventional feeds. Chickens fed with organic feeds tend to have a longer transit time of digesta in their stomachs compared to chickens fed with conventional feeds, likely due to the higher fiber content in organic feeds, which requires more time for digestion (Habibi *et al.*, 2024). The lower digestibility of organic feeds may result in larger amounts of undigested material in the gastrointestinal tract, which serves as a food source for various parasites. When food moves more slowly through the digestive system, it remains available for a longer period, providing ample sustenance for parasites like *Ascaridia sp.* and *Heterakis sp.* This prolonged exposure and availability of nutrients in the gut environment favor the growth and reproduction of these parasites, resulting in a greater number of worms infesting younger chickens (Knutie *et al.*, 2017).

Conversely, chickens initially receiving a conventional diet and later transitioning to organic treatment at 23 days old experienced notable impacts on gut health and immune system development. The enhanced nutrition and supplementation in conventional feeds could have improved their immune response and overall development, enabling them to better fend off parasites, thus explaining their lower parasitic load compared to chickens fed with organic feeds from day 1 (Shohana *et al.*, 2023; Song *et al.*, 2021). The conventional feed used in the study contains high-quality protein sources, essential fatty acids, a mix of vitamins and minerals, and various additives that enhance the digestibility and gut health of the chickens raised in organic treatment on day 23. The addition of easily absorbable amino acids such as DL-methionine, L-lysine, and L-threonine ensures an adequate supply for optimal growth and repair of gut tissues. Research indicates that DL-methionine supplementation positively impacts growth performance, feed efficiency, and protein synthesis. These amino acids help in the regeneration and elongation of villi, ensuring a larger surface area for nutrient absorption in broilers, improving body weight gain and carcass variables (Maynard *et al.*, 2023). Better absorption of nutrients reduces the amount of food accessible to parasites, impeding their development and proliferative capacity. Conventional feeds ensure excellent gut health, which reduces the environment that favors parasite development and, ultimately, the overall burden of worms in chickens (Adedokun & Olojede, 2019; Bennett *et al.*, 2011).

The lower nematode burden during the initial days of the chickens in the organic treatment at day 23 could result in a lesser competition for *Raillietina sp.*, since *Raillietina* could be acquired at a much later part of the chicken's life. This condition could potentially facilitate the establishment and growth of the cestode. It's also important to consider potential sample or human errors in the collection and examination process. Not all tapeworms collected in the samples possess a scolex, which is the basis for counting, leading to a

potential underestimation of *Raillietina sp* as some studies indicated that this cestode is the most prevalent in chickens (Mathews *et al.*, 2024).

The relationship between parasite prevalence, intensity of infection, and chicken production parameters are critical aspect to consider in organic poultry farming. In the study, the slaughter weight carcass weight of the chickens fed organic feeds from day 23 was greater than the average weight of the chicks fed organic feeds from day 1 (Table 2). Although results are not statistically significant, the data suggest a connection between increased parasite rates and early exposure to organic feed, which may have an impact on the growth and performance of hens.

Table 2. Average body weight of Hubbard Chicken Organically fed at Day 1 and Day 23.

Parameters ^{NS}	Day 1	Day 23	SEM
Slaughter weight (g)	1771.20	1645.60	80.0
Carcass weight (g)	1204.80	11447.60	57.1

NS – not significant ($p \geq 0.05$)

Parasitic infections have been shown to alter the function of the intestinal tract, generating deficiencies in the absorption of nutrients and lowering productive performance, leading to economic losses (Mesa-Pineda *et al.*, 2021). These parasites can compete with the host for nutrients, leading to reduced feed efficiency and compromised growth rates. Additionally, parasitic infections can trigger inflammatory responses and metabolic changes in chickens, further impacting their overall health and ability to convert feed into body weight. The energy diverted towards combating parasitic infections and dealing with associated physiological stressors can divert resources away from growth and development, ultimately resulting in lower slaughter weights compared to chickens with lower parasite burdens (Wernery, 2015; Freitas *et al.*, 2023).

Although the results in this study were deemed not statistically significant. A study with a higher sample size is necessary to further strengthen the claims in this study. Also, other studies to include other parasites invisible to the naked eye, including protozoans, are necessary. Nevertheless, the results could suggest a possible relationship between the timing of organic feeding, prevalence and intensity of infection, and several production parameters.

CONCLUSION

Although the results of these experiments are not significant, due to the limited sample size, the findings could serve as some evidence that the timing of provision of organic feeds that may have lower digestibility based on their ingredients could influence the type of helminth infections. The parasite burden could influence the feed efficiency and growth rate of organic chickens. This has a big influence on the organic market as organic poultry farmers may experience higher production costs, longer production cycles, and decreased profitability. Targeted parasite control techniques must be put into practice to minimize the negative effects of parasites on the growth performance of organic chickens and increase

their productivity. These include routine monitoring, deliberate deworming protocols, and nutrition optimization.

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