

**IDENTIFICATION OF INTERNAL PARASITES OF MEAT-TYPE RABBITS
(*Oryctolagus cuniculus* L.) THROUGH FECALYSIS IN A STATE COLLEGE
IN BULACAN, PHILIPPINES**

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Abstract— Meat-type rabbits are relatively new compared to other livestock raised for meat in the Philippines. In this regard, the occurrence of parasites is not yet well-documented among rabbit farms in the country. This study determined the presence and identity of gastrointestinal parasites of rabbits farmed inside a state college through floatation and sedimentation procedures of fecal analysis. Floatation technique separates the eggs from fecal debris by floating them on a variety of solutions, whereas sedimentation technique allows heavier parasite eggs to sink to the bottom of the solution. Both procedures were conducted on 53 rabbits of varying ages. Eggs of intestinal coccidia were found on all rabbits, having a prevalence of 100%. Eggs of hepatic coccidia (*Eimeria stiedae*), and tapeworm (*Taenia* spp.) were found at 15% and 7.5% occurrence, respectively, among all the rabbits. *E. stiedae* and *Taenia* spp. were found only in young rabbits aged two months old and below, at an prevalence of 66.67% and 33.33%, respectively, for this age group. The parasites were seen using the floatation technique, whereas only coccidia were seen in sedimentation technique. Results revealed that mixed infection of intestinal coccidia with hepatic coccidia, and intestinal coccidia with tapeworm, occurred in young rabbits only. The rabbits did not show clinical signs related to the parasites discovered, owing to the low amount of parasitic load, and to the low pathogenicity of the parasites. Implications for rabbit farm hygiene and sanitation, and for rabbit health management were discussed for rabbit producers in the country.

Keywords — Bulacan, fecalysis, meat-type rabbit, rabbit parasites

INTRODUCTION

A parasite is a smaller organism that lives on or in, and at the expense of a larger organism called the host (Bowman, 2009). Meat-type rabbits are relatively new compared to other livestock raised for meat in the Philippines. In this regard, the occurrence of parasites is not yet well-documented among rabbit farms in the country. For internal parasites, parasitic worms and protozoa are the two major classifications. Parasitic worms (helminths) are either roundworms (nematodes), tapeworms (cestodes), or flukes (trematodes). On the other hand, protozoa, such as coccidian, are microscopic unicellular organisms with specialized organelles (Gosling, 2005).

In order to detect the presence of parasites, the procedure for live animals is fecal sample analysis or simply fecalysis. Fecalysis can be done through various processes. Kaufman (1996) enumerated the techniques and specific procedures in the diagnosis of parasitic infections of domestic animals, including floatation and sedimentation methods.

Among the parasites that can be detected from fecalysis are coccidia, which are protozoa that invade either the mucosa of the intestine, colon, cecum, or the epithelium of various ducts (Harcourt-Brown, 2002). Fourteen species have been described in the domestic rabbit, only one of these inhabit bile ducts (*Eimeria stiedae*) and causes hepatic coccidiosis, while the rest are found in the small and large intestines (Harcourt-Brown, 2002). Among the intestinal coccidia, the most common are *E. magna*, *E. perforans*, and *E. media*, which seldom cause significant disease but are readily seen in fecal samples, while *E. intestinalis* and *E. flavescens* seldom occur but are pathogenic (McNitt et al, 2013).

Speight (2019) reported that some of the most common internal parasites in rabbits. These are tapeworms (*Taenia*

serialis, *T. pisiformis*), and coccidian protozoa (*E. stiedae*, other *Eimeria* spp.) Cousquer (2008), on the other hand, asserts that the only roundworm to occur in domestic rabbits is the oxyurid worm *Passalurus ambiguus*, which is sometimes referred to as a "pinworm". Aside from *Eimeria* spp., Cosquer (2008) also adds that rabbits can have *Toxoplasma gondii* and *Ecephalitozoon cuniculi*.

This study determined the presence of these mentioned parasites from the Rabbit Production Project of Bulacan Agricultural State College (BASC), San Ildefonso, Bulacan, Philippines. Results of this study were used as additional data for IEC materials on rabbit pest and disease management.

The general objective of this study is to determine the occurrence of internal parasites in rabbits at BASC, San Ildefonso, Bulacan, Philippines. Specifically, it aimed: a. To detect the presence of infection involving gastro-intestinal parasites in rabbits through floatation and sedimentation techniques of fecalysis; and, b. To identify the internal parasites detected through microscopic examination of the eggs detected in the samples.

MATERIALS AND METHODS

Research Design

This research was a non-experimental observational study, using the cross-sectional or prevalence study design. According to Pfeiffer (2009), this type of study is used to obtain baseline information about a population, taking a random sample of animals from a population at one point in time, or at one point in the life of each animal. Each animal is examined for the presence of disease and their status with regard to risk factors.

Experimental Animals

The studied rabbits were of New Zealand White breed, and were housed in

galvanized wire cages and fresh water was automatically available at all times. These rabbits were fed with a commercial standard rabbit diet without any anti-parasitic or anti-coccidian drugs prior to sampling. Feeding with grasses is done in the project in addition with the pellets when grasses are abundant; this was not done during the study which was conducted from January to March 2021. Within the period of collection, a total of 53 rabbits were sampled from the total population of 212. Stratified random sampling was done according to age (2 months and below, 3 months, 4 months, and 5 months and above), taking 25% from each age group as samples. Each of the 53 rabbits was only sampled once.

The health program in the animal project includes ivermectin injection to rabbits that will be used as breeders when they reach 4 months of age, and as maintenance to breeders every 6 months. Ivermectin is a broad-spectrum antiparasiticide which is indicated both for internal and external parasites. The sampled animals were only those that have not received any ivermectin injection in the past five months. Antibiotics and other anti-parasiticide are not routinely given since the project is advocating natural farming system like other rabbit farms in the country.

Data Collection (Fecalysis Procedures)

Fresh fecal samples were obtained as immediately excreted using screens just below the cages. For detection of helminth and coccidian infections, simple flotation and sedimentation techniques were performed. These methods detect different types of parasite eggs according to their weight and specific gravity.

Simple Flotation Method

The study followed the simple flotation method, as described by Sirois (2011) using sugar flotation solution. About 2-5 g of feces was placed on a small plastic cup, added with 30 mL sugar solution, mixed thoroughly, strained with a metal strainer and poured

into a test tube. The test tube is filled to form a convex dome (meniscus), then covered with a cover slip, and allowed to stand for 20 minutes. The cover slip was placed on a glass slide with the fluid side down, and examined using the LPO and HPO (100X and 400X magnifications).

When feces are emulsified in liquids of high specific gravity and either centrifuged or allowed to stand, the worm eggs and many protozoan cysts float to the top while the heavy coarse debris settles to the bottom. The top film can then be removed and examined. Nematode and cestode eggs float in a liquid with a specific gravity of 1.1-1.2. Trematode eggs, which are much heavier, require a specific gravity of 1.3-1.35.

Sedimentation Method

The standard sedimentation method according to Sirois (2011) was used. The fecal sample was mixed with water, strained into a test tube, and allowed to remain undisturbed for at least 20 minutes. The supernatant is poured off, and drops from the upper, middle and lower portions of the sediment are examined microscopically using the LPO and HPO.

Identification of Parasite Eggs

Slides with observed parasite eggs were further scrutinized through microscopic examination under high power objective. Reference books on parasitology served as guide in the identification of parasite eggs through the pictures and description of the oocysts. The veterinarians who were part of the study team identified the parasites.

RESULTS AND DISCUSSION

In this study, three types of parasites were observed from the animals: intestinal coccidia (*Eimeria* spp.), hepatic coccidia (*Eimeria stiedae*) and a tapeworm (*Taenia* sp.). All these parasites were seen using the flotation technique, whereas only the coccidia were seen in sedimentation

technique. Egg per gram counting was not done. The observed eggs were few, with only three to five eggs seen in a whole microscopic slide for most of the samples. The study focused on the identification of the parasite eggs.

Intestinal Coccidia

Table 1 shows that intestinal coccidia belonging to genus *Eimeria* were observed from all the animals. *Eimeria* contain four oocysts, each with four sporozoites, and are identified based on morphology and knowledge of the host animal (Taylor et al., 2016).

Table 1. Frequency and Occurrence of Intestinal *Eimeria* spp. according to age of rabbits.

Age of Rabbit	Population (n)	F	Occurrence
2 months and below	12	12	100%
3 months	18	18	100%
4 months	6	6	100%
5 months and above	17	17	100%
Total (N)	53	53	100%

The present study shows that 100% of the studied animals, regardless of age, were positive to intestinal coccidia (*Eimeria* spp.). This reported prevalence is higher than the prevalence (73.9%) documented by Hadi (2021) in his study of infected local rabbits in Baghdad, Iraq. Another study conducted by Elshahawy and Elgoniemy (2018) stated that 49% prevalence of several species of protozoa (*Eimeria* spp. and *Cryptosporidium* oocysts) were found in domestic rabbits in Egypt.

Although positive with intestinal coccidiosis via fecalysis, all the rabbits in this study looked healthy and vigorous. As McNitt et al. (2013) pointed out, intestinal coccidia are more of a nuisance than anything else, because they are seldom

pathogenic. The intestinal coccidia in this study may have been acquired from the source of breeder rabbits, although water and forages are also plausible, in addition to the fact that the animals sampled were those not yet given any anti-parasitic medication.

Coccidiosis is one of common diseases in rabbits which is caused by protozoan parasites (Hadi, 2021). More than a dozen *Eimeria* spp. are documented from the intestine of rabbits. Intestinal coccidia are common in wild and domestic rabbits worldwide (Baker, 2007). *Eimeria magna* and *Eimeria irresidua* are the two most pathogenic coccidial species that affect the intestine of rabbits. The observed coccidia in the experimental animals were the less pathogenic species of *E. intestinalis*, *E. exigua* and *E. piriformis* (Figure 1). The small intestinal is their predilection site (Taylor et al., 2016).

Eimeria are parasites of epithelial cells. They enter the mucosa of the intestine, colon and cecum and the epithelium of different ducts. Infected rabbits void oocysts that need oxygen and a period of a several days to become infective, and ingestion of the oocyst discharges sporozoites into the duodenum after the oocyst has been destroyed down by digestive enzymes (Harcourt-Brown, 2002). The sporozoites invade cells and cause tissue damage as they complete their complex life cycle ultimately to release oocysts into the lumen of the gut (Harcourt-Brown, 2002; Varga, 2002). Despite of the subclinical form or no evident clinical signs observed in rabbits with intestinal *Eimeria* spp., when these animals become sick or stressed, the parasite may result to lower weight, diarrhea, and reduction of food absorbance and digestion, which finally result in a decline in profitability of rabbit production (Szkucik et al., 2014). Varga (2002) reported that Sulpha drugs medication in the feeds or drinking water can be used to treat coccidiosis in groups of rabbits, but Lukefahr (2010) added that they must not be used on a preventative basis.

The implication of the results of present study in the Philippines rabbit industry is that intestinal coccidiosis may be prevalent in rabbit farms, since majority are backyard users and do not also give regular deworming and anticoccidial medication. Even if considered mainly as non-pathogenic, the prevalence of infestation necessitates the formulation of a strategic prevention and control program against intestinal coccidiosis, which foremost includes proper floor design of cages and sanitation. According to Lukefahr (2010), to break the parasites' life cycle, the hard feces of rabbits should always fall through the floor of the hutch or cage. Control of rabbit coccidiosis involves daily cleaning of cages and hutches, provision of clean feeding troughs, and rearing on wire floors (Taylor et al., 2016).

Hepatic Coccidia

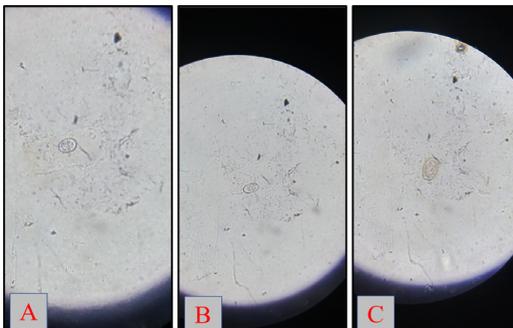


Fig. 1. Intestinal *Eimeria* spp.: (A) *Eimeria exigua*, (B) *Eimeria intestinalis*, and *Eimeria piriformis* oocyst under HPO.

Table 2 shows the prevalence of hepatic coccidia, wherein only 15% of the 53 total animals sampled for fecalysis had positive results, and these were those rabbits aging two months and below, for a prevalence of 66.67% in this age group.

These results were lower than the prevalence of 17.5% documented by Hadi (2021) in his study of infected local rabbits in Baghdad, Iraq. Another study conducted

by Kornaś et al. (2015) showed that 2.9% prevalence of *E. stiedae* were found in the rabbit farms in Poland. The 15% prevalence of *E. stiedae* may be connected with stress related with weaning time. Nevertheless, the source of water and grasses may have served as the main factors in infecting the colony of rabbits, and since the rabbits have not received any anti-parasitic treatment.

Table 2. Frequency and Occurrence of *Eimeria stiedae* according to age of rabbits.

Age of Rabbit	Population (n)	F	Occurence
2 months and below	12	8	66.67%
3 months	18	0	0%
4 months	6	0	0%
5 months and above	17	0	0%
Total (N)	53	8	15%

Hepatic coccidiosis is a severe disease of rabbits caused by the species-specific *Eimeria steidae*. Its oocysts are elongated ovoid or ellipsoidal, and measure 28 μ to 42 μ by 16 μ to 25 μ with a 6-μ to 10-μ micropyle (Figure 2). The wall is smooth and colorless to red-orange (Baker, 2007). According to Varga (2002), sporulation of the oocysts is important for infectivity and requires at least two days outside the host. Oocysts are exceptionally resistant and can remain viable in soil, on vegetation, and fomites for long periods of time. As reported by Xie et al. (2021), following the ingestion of sporulated oocysts, the sporozoites are released and mainly attack the liver and bile duct epithelial cells, where the merogony phase occurs. Merozoites reproduce within and exit from epithelial cells to repeat the process of development through the trophozoite and merogonous stages, and then the life cycle enters the gametogony phase, which produces a new generation of oocysts that are passed out in the feces.

In the external environment, oocyst sporulation (sporogony phase) occurs and results in the development of a new generation of infective oocysts for reinfection. Clinical signs are variable and subclinical disease is common. Younger rabbits are common to be infected severely, characterized by diarrhea, lethargy, anorexia, abdominal enlargement due to icterus, and hepatomegaly. The hepatomegaly can comprise up to 20% of the body weight. Mortality can occur in young rabbits with very severe disease. Mature rabbits are resistant (Baker, 2007).

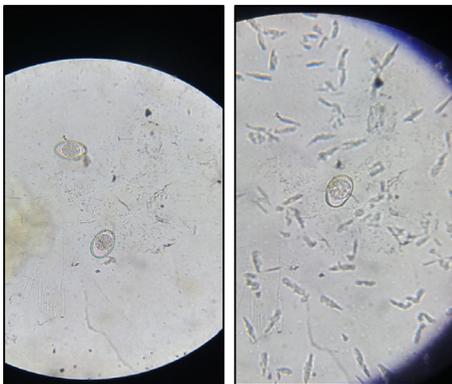


Fig. 2. *Eimeria stiedae* in 2 months old rabbit under HPO.

The condition can be treated with sulpha drugs via feed but may not be ingested in proper amounts by rabbits that are inappetent (Varga, 2002). Toltrazuril in the drinking water is highly effective in reducing oocyst output of both intestinal and hepatic *Eimeria* species. Other drugs reported to be effective include monensin, salinomycin, maduramycin, difluoromethylornithine, toltrazuril, methyl benzoate and clopidol in combination, and narasin (Baker, 2007).

The implication of the results of present study in the Philippine rabbit industry is that hepatic coccidiosis may be prevalent in newly-weaned rabbits which are the susceptible age group, taking into consideration also the fact that majority of raisers do not also give regular deworming

and anticoccidial medication. This is not much of a problem for rabbits that will be grown until three to four months or until slaughter age only. However, infected rabbits that look healthy may be used as breeders, and they can contaminate the surroundings if there is no proper sanitation in the farm. Heavily-infected breeders are also prone to suffer the severe signs of hepatic coccidiosis.

Tapeworm (*Taenia* sp.)

Table 3 shows the prevalence of intestinal worms (helminths), specifically cestodes (tapeworms) belonging to *Taenia* sp., wherein only 7.55% of the 53 total rabbits sampled for fecalysis had positive results, and these were also those rabbits aging two months and below, for a prevalence of 33.33% in this age group.

Table 3. Frequency and Occurrence of *Taenia* sp. according to age of rabbits.

Age of Rabbit	Population (n)	F	Occurrence
2 months and below	12	4	33.33%
3 months	18	0	0%
4 months	6	0	0%
5 months and above	17	0	0%
Total (N)	53	4	7.55%

The prevalence results for helminths (*Taenia* sp.) is lower than the reported study of Hadi (2021) which recorded 38.75% infection rate in the domesticated rabbit in Baghdad, Iraq. Another study conducted by Szkucik et al. (2014) recorded 4.74% prevalence of *Taenia* spp. infection were found in slaughtered rabbits in Poland. Possible sources of infection were forages from surroundings contaminated by feces of infected dogs.

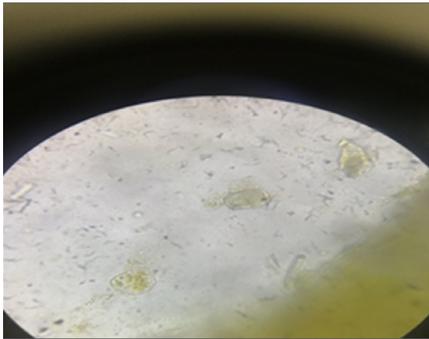


Fig. 3. *Taenia* spp. egg in 2 months old rabbit under HPO.

Rabbits are intermediate hosts of *Taenia* sp. throughout the world. Gravid proglottids passed from the definitive host, dogs, contain infective eggs (Baker, 2007). It may be problematic if rabbits are allowed to graze in contaminated pastures, and can be prevented by limiting access to dogs and cats (Keeble et al., 2016). Nabil (2020) stated that the ingested egg (Figure 3) hatches, and the hexacanth embryo enters the wall of the intestine and travels to its organ of choice via the portal veins, then grows and differentiates on capsules to form the second larval stage which consists of a fluid-filled bladder with a scolex called a cysticercus or as *Cysticercus pisiformis*. Baker (2007) also added that naturally occurring infections are rarely clinically evident. Metacestode movement in the liver can cause focal granulomatous inflammation and fibrosis. Severe infections thru experimental inoculation, can end in severe hepatitis with chronic wasting or death. There is no practical treatment for tapeworm (*Taenia* sp.) in rabbits (Lukefahr, 2010).

The implication of this present study is that tapeworm infection may be present in many local rabbit farms, since most local rabbit raisers provide forages as one of the main feed sources for rabbits, and these may come from contaminated environments. Thus, they have to be informed about thorough washing of fresh grasses before air-drying and giving them to their rabbits,

and making sure to get forages from clean environments only. Insect control, such as preventing flies in the rabbit housing can also help since parasitic eggs can also be transmitted mechanically by flies from the source to the feeds (rabbit pellets or forages).

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the study determined the presence and identity of intestinal and hepatic coccidia, and tapeworms, in rabbits farmed inside Bulacan Agricultural State College through flotation and sedimentation procedures. Results revealed that intestinal coccidia occurred in rabbits of all ages, but mixed infection of intestinal coccidia with hepatic coccidia, and intestinal coccidia with tapeworm, occurred in young rabbits only. All the rabbits did not show clinical signs related to the parasites discovered, owing to the low amount of parasitic load, and to the low pathogenicity of the parasites. Implications for rabbit farm hygiene and sanitation, and for rabbit health management were discussed for rabbit producers in the country.

Recommendations of the study for rabbit farmers, as contained in the IEC materials generated by the study, include cleanliness and sanitation in the farm, proper design of cage flooring (wire flooring), clean source of water and feeds, insect control, and guided administration of antiparasitic agents. Other studies on rabbit pests and diseases are needed to help in the promotion of rabbit production in the country, and to mitigate unwanted disease outbreaks in the future.

Further studies on the identification of parasites, including necropsy and histopathologic examination of intestines, liver, and other internal organs are recommended to determine other parasites that may be present, and the corresponding pathogenesis in infected in rabbits in the Philippines.

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