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Research Paper

Enterohepatic Helminths in Two Guinea Pig Groups (Inka Line and Chota Ecotype) From an Experimental Station in Northern Peru

Juan Rojas-Moncada[1], Vilma Polo Vargas[1], Jose Diaz Delgado[1], Teófilo Torrel Pajares[1], Luis Vargas-Rocha[1*]

1. Laboratory of Veterinary Parasitology and Parasitic Diseases, Faculty of Veterinary Sciences, National University of Cajamarca, Cajamarca, Peru.

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ABSTRACT

Introduction: Guinea pigs are rodents with considerable potential for small-scale production, and their breeding has expanded across various regions worldwide. These animals are susceptible to a wide range of parasites that can adversely affect their productivity. This study aimed to determine the prevalence of enterohepatic helminths, identify the parasitic genera, and compare the infection rates between two guinea pig groups (Inka Line and Chota Ecotype) from an agricultural experimental station in Cajamarca, a major guinea pig-producing area in northern Peru.

Materials & Methods: Fecal samples from 191 Inka Line and 162 Chota Ecotype guinea pigs were analyzed using the natural sedimentation method for trematodes and the concentration flotation for nematodes.

Results: Of the 353 animals examined, 305 were infected (86.4±3.58%). The prevalence in the Inka Line was 52.12±5.21% (184/353) and 34.28±4.95% (121/353) in the Chota Ecotype. Four helminth genera were identified: *Paraspidodera* spp., *Trichuris* spp., *Capillaria* spp., and *Fasciola hepatica*. Co-infections were common, affecting 63.35% of the Inka Line and 24.07% of the Chota Ecotype animals. Single infections were most frequent, followed by double, triple, and quadruple infections. The most common co-infection in the Inka Line was *Trichuris* spp./*Paraspidodera* spp. (30.89%), whereas in the Chota Ecotype, *Trichuris* spp./*Capillaria* spp. predominated (5.56%). Triple infections involving *F. hepatica*, *Trichuris* spp., and *Paraspidodera* spp. were more frequent in the Inka Line ($P<0.01$). The detection of *F. hepatica* underscores a potential zoonotic risk among intensively managed guinea pig populations.

Conclusion: In conclusion, a high prevalence of enterohepatic helminths was recorded in both groups, with distinct infection patterns, emphasizing the need for targeted parasitic control strategies.

Keywords:

Cavia porcellus, Intestinal parasite, Liver fluke, Parasitism, Polyparasitism.

*** Corresponding Author:**
Luis Vargas Rocha
Address: *Laboratory of Veterinary Parasitology and Parasitic Diseases, Faculty of Veterinary Sciences, National University of Cajamarca, Cajamarca, Peru.*
Tel: *+51 (939) 513028*
E-mail: *lvargasr17_1@unc.edu.pe*

1. Introduction

The breeding of guinea pigs (*Cavia porcellus*) contributes substantially to food security in South America, and it has gained importance in other regions due to their high reproductive rate, adaptability, and economic viability [1]. However, husbandry and management conditions frequently predispose these animals to parasitic infections that compromise their health and productivity. Internal parasites, particularly intestinal and hepatic helminths, are among the most significant constraints [2–5].

Despite evidence of parasitism affecting growth and reproduction, the impact of helminth infections in guinea pigs remains insufficiently studied. In other domestic species, these parasites are clearly associated with clinical signs such as reduced body condition, diarrhea, weight loss, and even mortality [6]. Therefore, identifying parasite genera in guinea pigs is critical for designing control programs.

The most frequently reported parasites in guinea pigs include *Paraspidodera uncinata*, *Eimeria caviae*, and *Trichostrongylus* spp., among others [7, 8]. Of particular relevance is *Fasciola hepatica*, a trematode of major zoonotic and productive importance. Although rarely documented in guinea pigs, Cajamarca, Peru is an endemic zone for *F. hepatica*, with reports in livestock, humans, and recently in guinea pigs [5, 9].

Two guinea pig groups, the Inka Line and the Chota Ecotype, have recently been incorporated into breeding programs. They differ morphologically and productively: the Inka Line exhibits chestnut-white rosette-shaped hair and higher carcass yield, whereas the Chota Ecotype displays a smooth tan coat and slightly higher prolificacy [10]. These biological and productive distinctions provide a logical basis for exploring whether susceptibility or resistance to parasitism differs between groups.

Considering that previous studies have documented helminths in guinea pigs from Cajamarca [5, 9, 11], updated monitoring is warranted. Therefore, the objective of this study was to determine the prevalence of enterohepatic helminths, identify the parasitic genera involved, and compare the infection rates between two guinea pig groups (Inka Line and Chota Ecotype) from an agricultural experimental station in northern Peru.

2. Materials and Methods

2.1. Study site and design

The study was conducted in two subsequent phases, first with Inka Line guinea pigs and subsequently with the Chota Ecotype, both at the National Institute of Agricultural Innovation (INIA) Baños del Inca Experimental Station (Cajamarca, Peru; 2,669 m a.s.l.; coordinates: -7.15903 S, -78.46192 W). The climate is dry temperate, with temperatures between 5 ˚C and 18 ˚C [12].

2.2. Husbandry conditions

Animals were raised in cement-walled pens with earthen floors measuring 1.2×1.5×0.5 m. Each pen contained one male and seven females. All animals were ≥1 year of age. Feeding consisted of green forage (ryegrass [*Lolium multiflorum*], alfalfa [*Medicago sativa*], clover [*Trifolium repens*]) supplemented with a commercial concentrate in a 3:1 ratio, corresponding to 10% of body weight. Balanced feed and water were provided in clay containers placed within the pens (Figure 1).

Deworming was conducted quarterly using triclabendazole against *F. hepatica* and fenbendazole for nematodes. Ectoparasites were treated with fipronil or ivermectin.

Both groups were sourced from the INIA station, were adults, and managed under the same feeding and sanitary program.

2.3. Sample size and collection

For the Inka Line pigs (n=191), the sample size was estimated based on a previously reported prevalence of 76% [3], with 95% confidence interval (CI), 5% precision, and a reference population of 600 animals. After obtaining the observed prevalence in the Inka Line, this value was used to calculate the required sample size for the Chota Ecotype guinea pigs (n=162), with 95% confidence, 5% precision, and a population of 400 animals.

For fecal collection, 2-4 guinea pigs per pen were placed overnight in cardboard boxes with 100 g of fresh ryegrass. The following morning, 15-20 g of feces were collected, stored in polyethylene bags, and transported under refrigeration to the Veterinary Parasitology Laboratory at the Universidad Nacional de Cajamarca.

Figure 1. Guinea pig rearing in an experimental station in northern Peru

Note: Animals are kept in cement-floor pens (a), with food and water evenly distributed in each pen for both Chota Ecotype (b) and Inka Line (c) guinea pigs.

2.4. Laboratory analysis

Sedimentation was applied for trematodes [13], and flotation by concentration (Sheather's sugar solution) for nematodes and cestodes [14]. Eggs were identified morphologically.

2.5. Statistical analysis

Prevalence was calculated as positive animals/total animals, with 95% CI; Wald or Clopper-Pearson). Prevalence ratios (PR) were used for group comparisons, tested with chi-square or Fisher's exact test (SPSS v27.0.1). Significance was set at P<0.05.

3. Results

Of the 353 animals examined, 305 tested positive (86.4±3.58%). The Inka Line had a higher prevalence (52.12±5.21%; 184/353) compared with the Chota Ecotype (34.28±4.95%; 121/353).

Four helminth genera were identified (*Paraspidodera* spp., *Trichuris* spp., *Capillaria* spp., and *F. hepatica*) (Figure 2). Nematodes predominated (82.72±3.94%), with *Paraspidodera* spp. and *Trichuris* spp. showing significant differences between groups (Table 1). The prevalence of *F. hepatica* infection was 18.7±4.07% (66/353).

Single infections were most common, followed by co-infections with two, three, and four species (Table 2). Inka Line guinea pigs had more frequent co-infections, particularly *Trichuris* spp. with *Paraspidodera* spp. (30.89%). In the Chota Ecotype, *Trichuris* spp. with *Capillaria* spp. (5.56%) was most frequent (Table 3). Triple infections involving *F. hepatica* occurred more frequently in the Inka Line guinea pigs (P<0.01).

4. Discussion

The overall prevalence of enterohepatic helminths in guinea pigs was high (86.4±3.58%). This level of infection is consistent with previous studies in Cajamarca and other regions of Peru [3, 11, 15, 16]. Community-based surveys have sometimes reported lower or more variable rates [3, 11]. The differences may reflect husbandry conditions: continuous housing at the experimental station and the resulting higher exposure risk compared with family systems.

Nematode infections were dominated by *Paraspidodera* spp. and *Trichuris* spp., a pattern similar to earlier reports in Peru and abroad [3, 15]. In this study, the Inka Line had particularly high levels of both parasites, which may be explained by pen microclimates and persistent environmental egg contamination. Previous work has also highlighted that overlapping intestinal niches favor the concurrent establishment of these nematodes [3].

Figure 2. Helminth eggs observed in fecal samples from guinea pigs

a) *Paraspidodera* spp., b) *F. hepatica*, c) *Trichuris* spp., d) *Capillaria* spp

Note: ×40 magnification; Scale 20 µm (correction factor 1.64).

The detection of *F. hepatica* (18.7±4.07%) is one of the most relevant findings. This prevalence is markedly higher than the 4.6% reported in nearby communities [5]. Local snail ecology, contaminated forage, and station management may explain this difference. Although the sedimentation technique is reliable [13], coprological methods detect only patent infections; therefore, some cases might have gone undetected. Quarterly triclabendazole treatments may also have influenced prevalence and raised concerns about emerging resistance, as noted in a regional study [9].

Polyparasitism was frequent, especially in the Inka Line. Previous surveys also found common co-infections in guinea pigs [11, 15–17]. In this population, the coexistence of *Trichuris* and *Paraspidodera* was particularly striking. Environmental contamination and the partial efficacy of anthelmintics likely contributed to these associations. These patterns illustrate how parasite communities interact under intensive management.

Table 1. Prevalence (%) of enterohepatic helminths by genus in two guinea pig groups (Inka Line and Chota Ecotype) from an agricultural experimental station in northern Peru

Parasite	Total (n=353)	Inka (n=191)	Chota (n=162)	P	PR (95% CI)
	Pos/%±95% CI	Pos/%±95% CI	Pos/%±95% CI		
Capillaria spp.	70/19.83±4.16	32/16.75±5.3	38/23.46±6.53	0.116	0.71 (0.47, 1.09)
Paraspidodera spp.	188/53.26±5.2	129/67.54±6.64	59/36.42±7.41	<0.001*	1.85 (1.48, 2.32)
Trichuris spp.	199/56.37±5.17	149/78.01±5.87	50/30.86±7.11	<0.001*	2.53 (1.98, 3.22)
F. hepatica	66/18.7±4.07	43/22.51±5.92	23/14.2±5.37	0.046*	1.59 (1, 2.51)

Abbreviations: Pos: Positive; CI: Confidence intervals (Wald method); PR: Prevalence ratio.

*Significant (chi-square test, P<0.05).

Table 2. Prevalence (%) of parasitic presentation in two guinea pig groups (Inka Line and Chota Ecotype) infected with enterohepatic helminths from an agricultural experimental station in northern Peru

Parasite Presentation	Inka (n=191)	Chota (n=162)	P	PR (95% CI)
	Pos/% (95% CI)	Pos/% (95% CI)		
One parasite	63/32.98 (26.67, 39.65)	82/50.62 (42.92, 58.32)	<0.001[*]	0.65 (0.51, 0.84)
Two parasites	81/42.41 (35.4, 49.42)	30/18.52 (12.54, 24.5)	<0.001[*]	2.29 (1.59, 3.29)
Three parasites	35/18.32 (12.84, 23.81)	8/4.94 (1.6, 8.27)	<0.001[*]	3.71 (1.77, 7.77)
Four parasites	5/2.62 (0.35, 4.88)	1/0.62 (0.02, 3.39)[C]	0.224	4.24 (0.5, 35.93)
Total	184/96.34 (93.67, 99)	121/74.69 (68, 81.39)	<0.001[*]	1.29 (1.17, 1.42)

Abbreviations: Pos: Positive; CI: Confidence intervals (Wald method); PR: Prevalence ratio.

[*]Significant (Chi-square/Fisher test, P<0.05), [C]Clopper-Pearson method.

Differences between the Inka Line and the Chota Ecotype must be interpreted with caution. Although prevalence and co-infections were higher in the Inka Line, there is no evidence linking these outcomes to genetic susceptibility. Both groups were managed under identical conditions, and sequential sampling introduces temporal confounding. Morphological and productive traits may influence exposure or immune responses, but such hypotheses require molecular and immunological confirmation.

The high prevalence observed underscores the importance of addressing parasite control within a One Health framework, recognizing the interconnection between animal, human, and environmental health. Guinea pig production in Andean systems typically involves close

Table 3. Prevalence (%) of parasite co-infection patterns in two guinea pig groups (Inka Line and Chota Ecotype) infected with enterohepatic helminths from an agricultural experimental station in northern Peru

Presentation	Parasite	Inka (n=191)	Chota (n=162)	P	PR (95% CI)
		Pos/% (95% CI)	Pos/% (95% CI)		
Two parasites	Fh/T	10/5.24 (2.08, 8.39)	3/1.85 (0.38, 5.32)[C]	0.093	2.83 (0.79, 10.1)
	Fh/P	3/1.76 (0.33, 4.52)[C]	4/2.47 (0.68, 6.2)[C]	0.707	0.64 (0.14, 2.8)
	Fh/C	0/nan, nan[~]	2/1.23 (0.15, 4.39)[C]	0.124	0 (nan, nan)[~]
	T/P	59/30.89 (24.34, 37.44)	8/4.94 (1.6, 8.27)	<0.001[*]	6.26 (3.08, 12.7)
	T/C	6/3.14 (0.67, 5.62)	9/5.56 (2.03, 9.08)	0.262	0.57 (0.21, 1.55)
	P/C	3/1.76 (0.33, 4.52)	4/2.47 (0.68, 6.2)[C]	0.707	0.64 (0.14, 2.8)
Three parasites	Fh/T/P	20/10.47 (6.13, 14.81)	3/1.85 (0.38, 5.32)[C]	0.001[*]	5.65 (1.71, 18.69)
	Fh/T/C	1/0.52 (0.01, 2.88)[C]	1/0.62 (0.02, 3.39)[C]	1.000	0.85 (0.05, 13.45)
	T/P/C	14/7.33 (3.63, 11.03)	4/2.47 (0.68, 6.2)[C]	0.054	2.97 (1, 9.84)
Four parasites	Fh/T/P/C	5/2.62 (0.35, 4.88)	1/0.62 (0.02, 3.39)[C]	0.224	4.24 (0.5, 35.93)
Total infected >1 parasite		121/63.35 (56.52, 70.18)	39/24.07 (17.49, 30.66)	<0.001[*]	2.63 (1.96, 3.53)

Abbreviations: Pos: Positive; CI: Confidence intervals; PR: Prevalence ratio; *F: Fasciola hepatica; T: Trichuris spp., P: Paraspidodera spp., C: Capillaria spp.*

[*]Significant (chi-square/Fisher test, P<0.01), [~]Not a number: the confidence interval could not be estimated due to a cell with a frequency of zero, [C]Clopper-Pearson method.

contact between animals and people, limited biosecurity, and frequent reuse of contaminated bedding or forage [18]. These conditions sustain infection cycles and facilitate zoonotic transmission, particularly of *F. hepatica*. Hence, management-based interventions (such as improving housing hygiene, implementing rotational cleaning schedules, and avoiding untreated forage from irrigated or snail-infested areas) are essential. These strategies contribute not only to animal health but also to food safety and environmental sustainability, aligning with current global efforts to reduce chemical dependence and antimicrobial residues in livestock production.

Several limitations should be acknowledged. Fecal collection outside normal housing could have altered results, and sequential sampling limited direct comparisons. Sample sizes per pen were small relative to the total number of animals, which may have underestimated clustering. Coprological diagnosis was restricted to helminths and did not include protozoa or molecular confirmation. Future studies should combine coprology with molecular tools, evaluate anthelmintic efficacy, and incorporate environmental monitoring or intermediate hosts.

5. Conclusion

In conclusion, the prevalence of enterohepatic helminths in guinea pigs from an experimental station in Cajamarca was high (86.4%). Infections involved *Capillaria* spp., *Paraspidodera* spp., *Trichuris* spp., and *F. hepatica*, occurring in both single and mixed forms. The detection of *F. hepatica* in intensively managed guinea pigs highlights a potential zoonotic risk and represents one of the most novel contributions of this study. The observed differences between Inka Line and Chota Ecotype guinea pigs suggest variation in infection patterns, but further controlled and molecular studies are needed to clarify whether these differences reflect true biological susceptibility.

Considering the high prevalence and zoonotic potential of the identified parasites, it is essential to promote integrated parasite control strategies that combine husbandry practices, environmental management, and periodic monitoring. The responsible use of antiparasitic drugs should be restricted mainly to breeding animals, as these remain longer within production systems, while care must be taken to avoid drug residues in meat intended for human consumption. The incorporation of ethnoveterinary approaches, such as the use of antiparasitic plants, may represent an environmentally sustainable and residue-free alternative. These preventive measures are key to reducing parasite transmission among guinea pigs and minimizing public health risks in rural communities where guinea pig meat forms part of traditional diets.

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Compliance with ethical guidelines

The authors adhered to the Peruvian Animal Protection and Welfare Law (Ley N° 30407). Animal welfare was prioritized at all times, and the guinea pigs were guaranteed the five freedoms of animal welfare. The Faculty of Veterinary Sciences (National University of Cajamarca) approved the study as per Faculty Council Resolutions No. 074-2015-FCV-UNC and No. 104-2018-FCV-UNC.

Data availability

All relevant data are included in this manuscript. If further information is required, please contact the corresponding author.

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Authors' contributions

Conceptualization and study design: Juan Rojas-Moncada, Vilma Polo Vargas, and Jose Diaz Delgado; Data acquisition: Vilma Polo Vargas and Jose Diaz Delgado; Analysis, data interpretation, statistical analysis, and writing the original draft: Luis Vargas-Rocha; Review and editing: Juan Rojas-Moncada and Teófilo Torrel Pajares.

Conflict of interest

The authors declared no conflict of interest.

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