

## ***Fasciola hepatica* PREVALENCE IN CATTLE FROM THE ABANCAY, CURAHUASI AND TAMBURCO DISTRICTS, ABANCAY PROVINCE-APURÍMAC, PERU DURING THE 2018 RAINY SEASON**

*María Tirado Nicoletti<sup>1</sup>, Eva Casas Astos<sup>1,2</sup>, Luis Cerro Temoche<sup>2</sup> and  
Sebastiana Bernilla De La Cruz<sup>3</sup>*

### ABSTRACT

This study aims to determine the prevalence of *Fasciola hepatica* in cattle from the Abancay, Curahuasi, and Tamburco districts in the Abancay province, Apurímac, Peru, during the 2018 rainy season, and the association between prevalence and age, breed, and district of origin. In total, 295 stool samples were collected, namely 34 from Tamburco, 193 from Curahuasi and 68 from Abancay. For coproparasitological evaluation, the four-sieve sedimentation technique described by Girão and Ueno was used. The total prevalence of *F. hepatica* in the cattle sampled in this study was 50.8% (150/295), and the prevalence by district was 42.6% (29/68) in Abancay, 53.8% (104/193) in Curahuasi, and 50% (17/34) in Tamburco. No significant association was found with the variable district of origin ( $p < 0.05$ ). However, using a bivariate logistic regression analysis, a significant association was found between *F. hepatica* prevalence and the breed variable ( $p = 0.008$ ). A similar significant association with the breed variable ( $p = 0.007$ ) was also found using a multiple logistic regression analysis. The high prevalence of *F. hepatica* identified in this study is consistent with previous reports made in the Apurímac Region, an area considered hyperendemic for the parasite, thus highlighting the need for effective health programs to control disease distribution, which may have an economic and, because of its zoonotic character, public health impact.

**KEY WORDS:** *Fasciola hepatica*; liver fluke disease; cattle; Abancay; Apurímac; Peru.

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1. Scientific University of the South (UCSUR), Laboratory of Parasitology of Veterinary Medicine and Zootechnics, Lima, Peru.
  2. National University of San Marcos (Universidad Nacional Mayor de San Marcos – UNMSM), Faculty of Veterinary Medicine, Department of Animal Health and Public Health, Lima, Peru.
  3. National University Micaela Bastidas de Apurímac (Universidad Nacional Micaela Bastidas de Apurímac-UNAMBA), Faculty of Veterinary Medicine and Zootechnics, Abancay, Peru.

María Fernanda Tirado Nicoletti: <https://orcid.org/0000-0002-8684-5420>; Eva Consuelo Casas Astos: <https://orcid.org/0000-0002-4378-6862>; Luis Fernando Cerro Temoche: <https://orcid.org/0000-0003-3207-1041>; Sebastiana Virginia Bernilla De la Cruz: <https://orcid.org/0000-0003-2005-2556>

Corresponding author: Eva Casas. E-mail: [ecasasa@unmsm.edu.pe](mailto:ecasasa@unmsm.edu.pe)

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## INTRODUCTION

Fasciolosis, or liver fluke disease, is a zoonotic parasitic disease with worldwide distribution caused by the trematode *Fasciola hepatica* (González-Lanza et al., 1989, Marcos Raymundo et al., 2004, Carrada-Bravo, 2007, Abdul-Hadi et al., 2009). Fasciolosis primarily affects ruminants, equids, swine, South American camelids, rodents, lagomorphs and wild animals (Carrada-Bravo, 2003; Marcos Raymundo et al., 2004). It is considered a public health concern due to the high prevalence of human infection in endemic areas of the disease (Espinoza et al., 2010).

Valderrama Pomé (2016) proposed a new classification of endemic zones owing to the high prevalence of *F. hepatica*. This classification, based on the prevalence of *F. hepatica* was as follows: hyperendemic (>50%), mesoendemic (10–50%), and hypoendemic (<10%).

Combining climatic and environmental factors, the occurrence of fasciolosis is commonly associated with areas with temperatures fluctuating between 10 °C and 26 °C (Mitchell, 2003), high humidity and an adequate precipitation. On the other hand, an inadequate pasture management contributes to the spread of snails of the genus *Lymnaea*, which leads to an increased infestation of distomatosis in cows (Murga et al, 2019). The altitude and humidity could generate a favorable environment for the infection. Ticona et al (2010) reported that the altitude where the animals were found was an important risk factor for infection by *F. hepatica*. It is known that the lowest areas (3,000-3,300 meters above sea level (m.a.s.l.)) with slopes and arid soil showed a low prevalence of the infection (7.4%) than high areas (3,301-3,600 m.a.s.l. – 3,601-3,900 m.a.s.l.) which showed 36.6% and 42.7% of prevalence, respectively.

Hyperendemic zones have areas with a very high disease prevalence, mainly due to climatic factors, such as temperatures of 10–30°C and altitudes of 2,000–4,500 m.a.s.l., which may promote the survival and development of trematode eggs, as well as the presence of the intermediate host (snails of the Lymnaeidae family) in pastures and bodies of fresh water (Howell et al., 2015). As the Abancay province provides these conditions, the disease persistence is high, and its management is challenging in the region (INEI, 2000).

Liver fluke disease is considered to be among the parasitosis that result in major economic losses in the livestock industry, affecting mainly cattle and sheep (Marcos Raymundo et al., 2004, Ticona, 2010). Annual livestock economic losses in Peru exceed 50 million dollars due to condemned livers, costs associated with pharmacologic treatment, low weight gain, reduced animal fertility and productivity, among others (Espinoza et al., 2010).

Animal fluke disease is distributed in 21 of the country's 24 departments, according to reports issued by the National Agrarian Health Service (*Servicio Nacional de Sanidad Agraria* – SENASA) of Peru (Espinoza et al., 2010). In 2005, SENASA's health inspection reports showed 158,039 condemned livers affected by *F. hepatica*, which accounted for 24.2% of all slaughtered animals in the country, with a prevalence of 80.1% in the Apurimac department (SENASA, 2020). After Lima, Apurimac is the department with the highest liver failure due to *F. hepatica* (Carrion, 2013), and, therefore, it is considered a hyperendemic zone (Merino, 2013). In 2012, a 79.5% prevalence of liver fluke disease was reported in the cattle at the Abancay Municipal slaughterhouse (Carrion, 2013). This study aimed to determine the prevalence of *F. hepatica* in cattle of the Abancay, Curahuasi, and Tamburco districts, Abancay province, Apurimac, during the 2018 rainy season, and to define the association between parameters such as age, breed, and district of origin with the prevalence of *F. hepatica*.

## MATERIAL AND METHODS

The study was conducted in the Abancay, Curahuasi and Tamburco districts, three of the nine districts of the Abancay Province, Apurimac Department, Peru, during the rainy season from January to March 2018.

The Abancay district is located at 2,378 m.a.s.l., 13°38'02"S latitude and 72°52'52"W longitude. It has a dry and temperate climate, an average temperature of 10°C, average precipitation of 205 mm, and 81% relative humidity. The Curahuasi district is located at 2,688 m.a.s.l., 13°33'9.4"S latitude and 72°44'5.6"W longitude. It has a dry climate, an average temperature of 15.9°C, average precipitation of 104 mm, and 78.3% relative humidity. The Tamburco district is located at 2,581 m.a.s.l., 13°37'01"S latitude and 72°52'16"W longitude. It has a dry climate, an average temperature of 13°C, an average precipitation of 0.29 mm, and 81.3% relative humidity (CESEL, 2013; INEI, 2000; SENAMHI, 2010).

To determine the sample size, we used the finite population formula (Daniel, 1996). A total of 295 fecal samples were collected, of which 34 were from Tamburco (nine farms), 193 from Curahuasi (80 farms), and 68 from Abancay (28 farms). The herds were randomly chosen, and samples were collected from apparently healthy cattle of all ages and both sexes. Animals incorporated into a herd in the last three months were excluded from the study. The animals were divided into 4 age groups: animals younger than 6 months, between 6 and 18 months, between 18 and 30 months, and older than 30 months (MDRyT, 2012). The association of age group, breed, and district of origin with the prevalence of *F. hepatica* was assessed.

All fecal samples (approximately 20g. of feces per animal) were collected with obstetric gloves directly from the anus and received in labeled plastic bags. Then were transported in containers at a temperature of 4-6 °C to the Parasitology Laboratory of the Faculty of Veterinary Medicine of the National University Micaela Bastidas of Apurímac (*Universidad Nacional Micaela Bastidas de Apurímac*, UNAMBA) and to the Microbiology and Parasitology Laboratory of the Scientific University of the South (*Universidad Científica del Sur* - UCSUR) for coproparasitological evaluation using the four-sieve technique developed by Girão and Ueno (Girão & Ueno, 1985). A sample was considered as a positive test when an egg typical of *F. hepatica* was observed (all the sediment was analyzed). *Fasciola hepatica* eggs are ellipsoid, operculate, yellowish brown in color and 130 x 150 µm long by 60 x 90 µm wide (Soulsby, 1987). It is important to mention that *Paramphistomum* spp. has not been reported in the studied region.

The results were expressed as percentages with their 95% confidence intervals. The association between age group, breed and district of origin with the prevalence of *F. hepatica* was analyzed using the Chi-squared test. In addition, the strength of the association was evaluated in the software Stata 16 using bivariate and multivariate logistic regression tests.

## RESULTS

The table shows the prevalence of *F. hepatica* detected using the four-sieve technique by age group, breed, and district of origin. The overall prevalence was 50.8% (150/295) with a 95% confidence interval: 45.1% min – 56.5% max.

The chi-squared test showed a significant association with the breed variable ( $p=0.007$ ). The prevalence was 59.0% (85/144) in creole or cross-bred animals, 36.8% (28/76) in Holstein cattle and 49.3% (85/144) in Brown Swiss cattle.

In the bivariate logistic regression analysis, a significant association was found only with the breed variable ( $p=0.008$ ), with creole or cross-bred cattle being 2.4 times more susceptible to infection by *F. hepatica* than Holstein cattle ( $p=0.002$ ) and Brown Swiss cattle being 1.6 times more likely to be infected than Holstein cattle ( $p=0.122$ ). A multiple logistic regression analysis revealed a similar significant association with the breed variable ( $p=0.007$ ), whereas no significant association with the variables of age group ( $p=0.987$ ) and district of origin was detected ( $p=0.244$ ).

*Table.* Prevalence of bovine fasciolosis assessed in a coprological study in three Abancay districts, by age group, district and breed – 2018.

	Positive	Total	Prevalence	95% confidence interval		Significance
				Minimum	Maximum	
Age group						1.000
Younger than 6 months	9	18	50.0 %	26.9%	73.1%	
From 6 to 18 months	35	69	50.7 %	38.9%	62.5%	
From 18 to 30 months	17	33	51.5 %	34.4%	68.5%	
Older than 30 months	89	175	50.8 %	43.4%	58.2%	
District						0.279
Abancay	29	68	42.6 %	30.8 %	54.4 %	
Curahuasi	104	193	53.8 %	46.8 %	60.9 %	
Tamburco	17	34	50.0 %	33.1 %	66.8 %	
Breed						0.007
Brown Swiss	37	75	49.3 %	38.0 %	60.6 %	
Holstein	28	76	36.8 %	26.0 %	47.6 %	
Creole or Cross-bred	85	144	59.0 %	51.0 %	67.0 %	
Total	150	295	50.8 %	45.1 %	56.5 %	

## DISCUSSION

The high prevalence of *F. hepatica* observed in this study corroborates the previous reports in the Apurímac district that showed prevalence rates ranging from 24.6% to 80.4%, mainly in condemned livers in slaughterhouses (Carrión, 2013; Merino, 2013; Torvisco & Abelid, 2019). Carrión, (2013) found 79.5% infected livers in the Abancay Municipal slaughterhouse. Abancay is considered an hyperendemic zone for *F. hepatica* and the region with the highest number of condemned livers after Lima (Espinoza et al., 2010). At higher altitudes the rainy seasons overlap with winter, and the snail population increases alongside with the risk of infection. Moreover, extensive breeding favors the presence of the disease as the animals are in direct contact with the infective form of the parasite (Leguía, 1991). Our analysis showed no significant association ( $p=0.279$ ) between the study districts and the prevalence of *F. hepatica*, possibly because the three districts have similar climatological (11.7–23.8 °C) and geographical (2,581, 2,688, and 2,378 m.a.s.l.) characteristics, as mentioned above, which did not lead to the marked differences in the prevalence of the parasite between these areas.

Techniques based on the direct observation of characteristic eggs in the feces used to diagnose animals positive for fluke disease are useful in identification of chronic cases, as *Fasciola* begin oviposition when they reach the hepatic ducts after a 6 to 8 week-long hepatic migration (Andrews, 1998). Therefore, when the parasite is migrating into the liver parenchyma, acute and subacute cases of infection remain undetected.

When evaluating the age group variable, no significant difference was found ( $p=1.000$ ). However, previous studies reported higher coprological prevalence rates in animals older than 3 years in Peru (Condemayta et al., 1993; Ticona et al., 2010; Valderrama Pomé, 2016) and worldwide (Sánchez-Andrade et al., 2002; Moriena et al., 2007). However, infected adults generally do not show symptoms even in the chronic phase of the disease and they develop a form of resistance to reinfections (Barriga, 2002). Nevertheless, a study conducted in the Ayacucho Department showed a higher prevalence in animals younger than one year old (38%) than in other age groups (Trujillo & Valderrama Pomé, 2017). Some studies reported that adult cattle reach a balance with fluke infections, and thus prevent reinfections by the parasite by hindering future *F. hepatica* parasitism (González-Lanza et al., 1989; Ticona et al., 2010). Cordero del Campillo et al. (1999) indicate that young animals are generally more affected than the adult ones and this difference is related to the development of immune mechanisms and to the connective tissue of the animals.

Consistent with previous reports by Sifuentes (2022) and Valderrama Pomé (2016), when evaluating the breed variable, we found that Creole cattle have a higher predisposition for infection with *F. hepatica* than improved breeds. In contrast, Diaz-Quevedo et al. (2021) showed that Brown Swiss has higher susceptibility than Creole, Cross, Fleckvieh and Holstein breeds.

In summary, the present study demonstrated high prevalence rates of *F. hepatica* in the Abancay, Tamburco and Curahuasi districts in the Abancay Province. These findings are important as liver fluke disease is considered a zoonosis and it causes considerable losses in livestock production and productivity. When visiting the study area, the authors were able to notice various factors that could increase the risk and trigger possible human liver fluke outbreaks in the study area: (1) the eating habits of the inhabitants, based on the consumption of raw short-stemmed vegetables such as watercress and lettuce, (2) the source of drinking water (water from rivers and ditches), and (3) the precarious health system in the study area. For the aforementioned reasons, control programs must be designed to alleviate the burden of this disease on its hosts.

In conclusion, the Abancay and Tamburco districts were classified as mesoendemic zones, whereas the Curahuasi district was classified as a hyperendemic zone. The prevalence of *F. hepatica* was significantly associated with the breed variable, and the creole or cross-bred cattle was the breed with the highest risk for infection with *F. hepatica*.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest to disclose.

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