Journal MVZ Cordoba
2020; 25(1):e1610.
https://doi.org/10.21897/rmvz.1610

Original

Economic losses and prevalence of *Fasciola hepatica* in cattle slaughtered in two cuban provinces

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Received: April 2019; Accepted: August 2019; Published: December 2019.

ABSTRACT

Objective. To determine the economic losses resulting from condemnation of affected livers and the presence of *Fasciola hepatica* in slaughtered cattle in the provinces of Camagüey and Holguín, Cuba. **Materials and Methods.** This study was based on the results from an anatomo-pathological examination performed at Felipe Fuentes and César Escalante slaughterhouses between January 2012 and December 2018. The losses, which totaled $ 80 312 USD (Holguín) and $ 327 152 USD (Camagüey), were estimated from the number of slaughtered and affected animals throughout the period. Analyses for the comparisons of proportions were made to animals affected by *F.hepatica,* whereas the economic losses due to liver condemnation were analyzed by Chi-square to determine the existence of significant differences among the proportions. Analysis of means (ANOM) was made to determine the significantly different proportions within the general average. **Results.** Significant differences ($p<0.001$) were observed in animals from different slaughterhouses in 11 months, excluding July. Meanwhile, the total losses due to condemnation of affected livers underwent significant differences ($p<0.001$) in all the months of the evaluation period. **Conclusions.** The highest values of economic losses and prevalence due to condemnation of livers affected by *F.hepatica* were observed in the province of Camagüey, which may have been linked to varying climatic conditions. Hence, evaluation of intermediary host dynamics and the larval stages of the trematode in the two provinces studied were recommended.

Keywords: Cattle, losses, prevalence, trematode (*Source: DeCS)*.

RESUMEN

Objetivo. Determinar las pérdidas económicas producidas por el decomiso de hígados afectados y la prevalencia de *Fasciola hepatica en* bovinos sacrificados en las provincias de Holguín y Camagüey, Cuba. **Materiales y m**étodos. Fueron utilizados los resultados del diagnóstico anatomopatológico realizado en los mataderos Felipe Fuentes y César Escalante durante el periodo comprendido entre enero de 2012 y diciembre de 2018. A partir de la cantidad de animales sacrificados y los afectados se calcularon las pérdidas que alcanzaron un valor de $80.312 USD (Holguín) y $32.7152 USD (Camagüey) para todo el período. Se realizaron análisis de comparación de proporciones para los animales afectados por *F. hepatica* y las pérdidas económicas por decomiso de hígados,

How to cite (Vancouver).
Palacio CD, Bertot VJ, Beltrao MM, Vázquez GA, Ortíz VR, Fortune NC. Economic losses and prevalence of Fasciola hepatica in cattle slaughtered in two Cuban provinces. Rev MVZ Cordoba. 2020; 25(1):e1610. DOI: https://doi.org/10.21897/rmvz.1610

ISSNe: 1909-0544

mediante una prueba Chi-cuadrado para determinar la existencia o no de diferencias significativas entre las proporciones y un análisis de medias (ANOM) para determinar cuáles proporciones son significativamente distintas del promedio general. **Resultados.** Se observó que en 11 meses los animales afectados difirieron significativamente ($p<0.001$) entre los mataderos excepto en el mes de julio, mientras que las pérdidas totales por decomisos de hígados afectados mostraron diferencias significativas ($p<0.001$) en todos los meses para el periodo evaluado. **Conclusiones.** Los mayores valores para las pérdidas económicas y prevalencia por el decomiso de hígados afectados por *F. hepatica* se presentaron en la provincia de Camagüey lo que pudiera estar relacionado con las condiciones climáticas diferentes, por lo que se recomienda evaluar la dinámica de los hospederos intermedios y las etapas larvarias de este trematodo en las dos provincias estudiadas.

Palabras clave: Ganado, pérdidas, prevalencia, trematodo *(Fuente: DeCS)*.

INTRODUCTION

Recent studies have considered that fasciolosis is an emerging widespread zoonosis, which is mostly found in ruminant *Fasciola hepatica*-endemic areas (1, 2). Although hard to quantify, every year, over 600 million domestic ruminants worldwide are infected, leading to incalculable economic losses in agriculture (3).

Fasciola hepatica is a globally-important trematode, causing diseases in multiple mammal species. *Fasciolosis* has been reported to cause $ 23£ million in economic losses to the livestock raising industry in the United Kingdom alone, which is still an estimated figure. The actual effects on production are not well defined yet; the losses are not only related to liver condemnation in slaughterhouses, but also to reduced daily weight gain due to poor food conversion, and drops in milk and wool production by the affected animals (4).

Fasciola hepatica infections are considered one of the most significant causes leading to low milk production and reduced fertility rates in livestock, with ensuing negative impacts on animals, which are often difficult to quantify (5).

This parasitosis is stimulated by conditions like the presence of susceptible animals, occurrence of infection in any climatic conditions (mostly in the rainy season), water containing metacercariae, inappropriate methods to dispose of feces, the existence of mollusks as intermediary hosts, and occasional inappropriate agricultural and zootechnical practices (6).

A study conducted in the province of Camagüey (6) concluded that the prevalence of *F. hepatica* varied from year to year and in municipalities, due to unstable climatic factors, such as the average precipitation values, particularly.

The aim of this paper was to determine the economic losses stemming from condemnation of affected livers and the prevalence of *Fasciola hepatica* in slaughtered cattle in provinces Camagüey and Holguín, Cuba.

MATERIALS AND METHODS

Animals and location. The data of slaughtered cattle recorded between January 2012 and December 2018 at Holguin's Felipe Fuentes (167.738 cases), and Camagüey's Cesar Escalante (195.315 cases) facilities in Cuba, were reviewed.

Overview. The monthly data of animals infected by *F. hepatica* resulting from the anatomo-pathological examination performed at the slaughterhouses were reviewed. The average weight and economic value of each condemned liver was 4 kg (7) and $ 0.90 USD/kg (the company's official price), respectively. The losses (condemned livers) were estimated with the following equation:

$$TEL = (a \times 4kg) \times 0.9USD$$

Where:

TEL=Total economic losses (kg)
a=Total condemned livers (units)

The prevalence of *F. hepatica* was calculated as follows,

$$Prevalence = (affected\ animals / slaughtered\ animals) * 100$$

Statistical analysis. Analyses for the comparison of proportions were made to animals affected by *F. hepatica,* whereas the economic losses caused by liver condemnation were analyzed by Chi-

square to determine the existence of significant differences among the proportions. Analysis of means (ANOM) was made to determine the significantly different proportions within the general average. A 95% confidence level interval was applied. Statgraphics Centurion XVI, version 16.1.18 was used for statistical analysis.

RESULTS

The greatest losses associated to liver condemnation occurred in 2015, 2017, and 2018 (Holguin), and in 2013, 2015, and 2016 (Camagüey). The highest prevalence values in Holguin were observed in 2015 and 2017, whereas the highest values in Camagüey occurred in 2012 and 2013 (Table 1).

Table 1. Summary of annual slaughterhouse cases

Year	Total slaughtered animals		Total affected animals		Total losses (USD)		Prevalence (%)	
	H	C	H	C	H	C	H	C
2012	25.628	23.935	1.639	11.769	5.901	47.076	6.1	50.3
2013	26.358	27.718	1.788	13.693	6.436	54.772	6.5	50.6
2014	35.980	29.331	2.559	11.162	9.213	44.648	7.2	38.4
2015	20.554	31.344	4.283	13.887	15.419	55.548	21.4	45.4
2016	10.764	28.468	3.794	12.171	13.658	48.684	19.8	44.3
2017	19.996	28.891	4.242	8.149	15.271	32.596	21.1	29.5
2018	28.458	25.628	4.004	10.957	14.414	43.828	14.8	45.6
Total	167.738	195.315	22.309	81.788	80.312	327.152	13.8	43.44

H= Holguín C= Camagüey

The highest prevalence values along the evaluation period in Holguin took place in August, September, and October; whereas the highest values for Camagüey were observed in March, April, and May. Meanwhile, the greatest economic losses due to liver condemnation were produced in October, November, and December in Holguin, and in February and March in Camagüey (Table 2).

Excluding July, the affected animals showed significant differences ($p<0.001$) between slaughterhouses throughout the year (Table 3). Meanwhile, the total losses related to affected liver condemnation underwent significant differences ($p<0.001$) in all the months during the evaluation period (Table 4).

Table 2. Summary of monthly slaughterhouse cases (2012-2018).

Month	Total slaughtered animals		Prevalence (%)	
	Holguin	Camagüey	Holguin	Camagüey
January	11.596	14.995	11.9	45.1
February	13.370	16.801	12.3	45.6
March	13.034	14.782	13.4	52.4
April	11.743	13.274	12.6	49.7
May	10.349	10.136	14.2	53.5
June	13.686	13.903	11.9	48.7
July	13.856	15.518	14.7	44.9
August	15.585	15.928	15.9	46.4
September	15.383	17.931	17.5	41.8
October	17.410	20.820	15.6	34.4
November	19.168	18.622	13.3	27.6
December	22.880	20.266	13.2	30.3

Table 3. Animals in slaughterhouses affected by *F.hepatica* (2012-2018).

Month	Total affected animals			
	Holguin	Camagüey	Size	Proportion
January	1.132	6.697	7.829	0.144591*
February	1.499	7.609	9.108	0.164581*
March	1.414	7.752	9.166	0.154266*
April	1.295	6.787	8.082	0.160233*
May	1.127	5.484	6.611	0.170473*
June	1.420	6.711	8.131	0.17464*
July	1.841	6.996	8.837	0.208329
August	2.329	6.864	9.193	0.253345*
September	2.305	7.326	9.631	0.239331*
October	2.682	6.980	9.662	0.277582*
November	2.349	5.288	7.637	0.307582*
December	2.916	6.145	9.061	0.321819*

(Chi-square=2193.75 Gl= 11 p= 0.0000)
*95% confidence decision limit: DLM= 0.23 Main line= 0.22 DIL= 0.20

Table 4. Total losses due to condemnation of livers affected by *F.hepatica* in slaughterhouses (2012-2018).

Month	Total losses (USD)			
	Holguin	Camagüey	Size	Proportion
January	4.075	26.788	30.863	0.132035*
February	5.396	30.436	35.832	0.150592*
March	5.090	31.008	36.098	0.141005*
April	4.662	27.148	31.810	0.146558*
May	4.057	21.936	25.993	0.156081*
June	5.112	26.844	31.956	0.159972*
July	6.627	27.984	34.611	0.191471*
August	8.384	27.456	35.840	0.233929*
September	8.298	29.304	37.602	0.220681*
October	9.657	27.920	37.577	0.256992*
November	8.456	21.152	29.608	0.285598*
December	10.498	24.580	35.078	0.299276*

Chi-square= 8096.41 Gl= 11 p= 0.0000
*95% confidence decision limit: DLM= 0.21 Main line= 0.20 DIL= 0.19

DISCUSSION

Economically, fascioliasis is probably the most prominent helminth infection. It has been reported to be the cause of major economic losses in many parts of the world due to its incidence in production animals, like cattle, sheep, goats, and buffaloes, totaling an estimated three billion US dollars a year, according to several authors (8,9,10).

Three slaughterhouses in Costa Rica reported the prevalence (2.33 and 2.55%) of *Fasciola hepatica* and economic losses ($67.438 USD) associated to liver condemnation. These reports emphasize on the negative economic impact of the trematode nationally, as well as the usefulness of damaged viscera condemnation and recording, as diagnostic tools for epidemiological surveillance to determine the state of this parasitosis (3).

A ten-year research done in Nigeria showed prevalence in municipal slaughterhouses in Minna (32.29%), Suleja (26.82%), Bida (30.47%), Kontagora (35.42%), and New-Bussa (36.72%), resulting in a general prevalence of 32.34% of animals affected by *Fasciola hepatica*. The economic losses caused by liver condemnation totaled $ 766.896 USD (11).

The prevalence of *Fasciola Hepatica* in slaughtered cattle has also been reported in Iran (1.1-4.8%), Iraq (3.3%), Pakistan (25.5%), Brazil (10.3%), Switzerland (10.9%), Scotland (5.0-8.5%), England and Wales (6.5%), Kenia (3.5-26.0%), Nigeria (7.0%) Saudi Arabia (9%), Zambia (60.9%), Ethiopia (24.3-90.7%) (12) and Switzerland (11%) (13). The high variation in the prevalence of bovine Fasciolosis in different countries and regions depends on factors like climatic conditions, cattle age and sex, and level of intermediary host contamination in the pasture (12).

A four-year study conducted in a Cuban company estimated economic losses of $16.121 USD derived from condemnation of livers affected by *Fasciola hepatica*, plus $316.078 and $170.664 USD reported as losses due to beef that was not produced, and $14.686 USD for anthelmintic drug use, leading to a total $517.550 USD in estimated losses (10).

The economic losses produced in the central provinces of Cuba (Cienfuegos, Villa Clara, and Sancti Spiritus) due to liver condemnation were considerable ($ 436.656 USD), which represented 18.0% of 273.450 animals slaughtered (7). Furthermore, a four-year study, (14) estimated that fascioliasis affected one out of three slaughtered cattle heads, causing $16.121 USD in losses due to liver condemnation, apart from the $316.078 and $170.664 USD reported for beef that was not produced, respectively.

These differences in annual prevalence may be attributed to variations in the weather conditions, since larval stage development and survival of *F. hepatica* in the grass are influenced by precipitations, relative humidity, and temperature (15, 16); hence, it is more commonly found on rainy locations, and poorly draining soils with high levels of water retention. These conditions are favorable for survival and multiplication of the intermediary hosts (*Galba cubensis* and *Pseudosuccinea columella*) and transmission of the parasite (16,17,18,19).

The economic losses derived from condemnation of livers affected by *F hepatica* are significant; they may vary in months or years and are dependent on the interaction of physiopathological and environmental aspects of the disease (climatic and geographical factors), which can determine the presence of intermediary hosts and the parasite in the environment (6).

Climate influences the free-living stages of the parasite and its intermediary host (*G. cubensis*), with precipitation-temperature interactions that have a major effect on the efficacy of transmission (20). The prevalence and economic impact of fasciolosis are linked to climatic and animal nutritional factors, which favor the persistence of the biological cycle of the helminth (6).

In conclusion, the highest economic losses and prevalence due to condemnation of livers affected by *F. hepatica* were observed in the province of Camagüey, which might be linked to different climatic conditions. Hence, evaluation of intermediate host dynamics and larval stages of this trematode is recommended for the two provinces studied.

REFERENCES

1. Bennema S, Ducheyne E, Vercruysse J, Claerebout E, Hendrickx G, Charlier J. Relative importance of management, meteorological and environmental factors in the spatial distribution of *Fasciola hepatica* in dairy cattle in a temperate climate zone. Int J Parasitol. 2011; 41(2):225-233. https://doi.org/10.1016/j.ijpara.2010.09.003

2. Bennema S, Scholte R, Molento M, Medeiros C, Carvalho O. *Fasciola hepatica* in Bovines in Brazil: Data Availability and Spatial Distribution. Rev Inst Med Trop. 2014; 56(1):35-41. http://dx.doi.org/10.1590/S0036-46652014000100005

3. Rojas D, Cartín JA. Prevalencia de *Fasciola hepatica* y pérdidas económicas asociadas al decomiso de hígados en tres mataderos de clase a de Costa Rica. Agronomía Costarricense. 2016; 40(2):53-62. https://revistas.ucr.ac.cr/index.php/agrocost/article/view/27366

4. Mazeri S, Rydevik G, Handel I, Bronsvoort B, Sargison N. Estimation of the impact of *Fasciola hepatica* infection on time taken for UK beef cattle to reach slaughter weight. Scientific Reports. 2017; 7(1):7319. https://doi.org/10.1038/s41598-017-07396-1

5. Fanke J, Charlier J, Steppin T, von Samson-Himmelstjerna G, Vercruysse J, Demeler J. Economic assessment of *Ostertagia ostertagi* and *Fasciola hepatica* infections in dairy cattle herds in Germany using Paracalc®. Veterinary Parasitology. 2017; 7-13. http://dx.doi.org/doi:10.1016/j.vetpar.2017.03.018

6. Palacio D, Bertot J, Molento M, Vázquez A, Izquierdo N, Arenal A, et al. Comportamiento estacional de *Fasciola hepatica* en bovinos sacrificados en el matadero de Chacuba, Camagüey, Cuba. Rev Prod Anim. 2017; 29(1):30-35. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2224792020170001000 06&lng=es&nrm=iso&tlng=es

7. González R, Pérez M, Brito S. Fasciolosis Bovina. Evaluación de las principales pérdidas provocadas en una empresa ganadera. Rev Salud Anim. 2007; 26(3):167-175. http://scielo.sld.cu/scielo.php?pid=S0253-570X2007000300007&script=sciarttext&tlng=pt

8. Kialanda M, Monteiro N, De Fontes-Pereira A, Castillo R, Simão E, Miranda I. Prevalencia de hígados confiscados y pérdidas económicas por Fasciola sp. en Huambo, Angola. Rev Health Animal. 2013; 35(2):12-15. http://revistas.censa.edu.cu/index.php/RSA/article/view/213

9. Selemetas N. Spatial Analysis and Risk Mapping of *Fasciola hepatica* Infection in Dairy Herds in Ireland. Geospat Health. 2015; 9(2):281-291. https://doi.org/10.4081/gh.2015.350

10. Alison H, Matthew SR, Pinchbeck G, Williams D. Epidemiology and Impact of *Fasciola hepatica* Exposure in High-Yielding Dairy Herds. Prev Vet Med. 2015; 121(1-2):41-48. https://doi.org/10.1016/j.prevetmed.2015.05.013

11. Yatswako S, Bida N. Survey of bovine fasciolosis burdens in trade cattle slaughtered at abattoirs in North-central Nigeria: The associated predisposing factors and economic implication. Parasite Epidemiol Control. 2017; 2(2):30-39. https://dx.doi.org/10.1016%2Fj.parepi.2017.02.001

12. Sario S, Yalc C. Estimating the total cost of bovine fasciolosis in Turkey. Animals of Tropical Medicine & Parasitology. 2011; 105(6):439-444. https://doi.org/10.1179/1364859411Y.0000000031

13. Schweizer G, Braun U, Deplazes P, Torgerson PR. Estimating the financial losses due to bovine fasciolosis in Switzerland. Vet Rec. 2005; 157(7):188-193. http://dx.doi.org/10.1136/vr.157.7.188

14. León M, Silveira E, Pérez J, Olazábal E. Evaluación de los factores que inciden en la mortalidad por fasciolosis en la provincia de Vi-lla Clara, Cuba. REDVET. 2013; 7(2):1-13. https://www.redalyc.org/articulo.oa?id=63612643008

15. Brito A. Prevalencia, decomisos de hígado y pérdidas económicas por *Fasciola hepatica* en mataderos bovinos de tres provincias de la región central de Cuba. REDVET. 2010; 11(4):1-7. https://www.redalyc.org/articulo.oa?id=63613155004

16. Vázquez A, Sánchez J, Alba A, Pointier J. Natural Prevalence in Cuban Populations of the lymnaeid snail Galba cubensis Infected with the Liver Fluke *Fasciola hepatica* Small Values do Matter. Parasitol Res. 2015; 114(11):4205-4210. https://doi.org/10.1007/s00436-015-4653-2

17. Ticona S, Chávez V, Casas V, Chavera C. Prevalencia de *Fasciola hepatica* en bovinos y ovinos de Vilcashuamán. Rev Investig Vet Perú. 2010; 21(2):3-15. http://www.scielo.org.pe/scielo.php?pid=S1609-91172010000200004&script=sci_arttext

18. Bosco A, Rinaldi L, Musella V. Outbreak of Acute Fasciolosis in Sheep Farms in a Mediterranean Area Arising As a Possible Consequence of Climate Change. Geospat Health. 2015; 9(2):319-324. https://doi.org/10.4081/gh.2015.354

19. Caminade C, Van Dijk J. Modelling Recent and Future Climatic Suitability for Fasciolosis in Europe. Geospat Health. 2015; 2(9):301-308. https://doi.10.4081/gh.2015.352

20. Giménez T, Núñez A, Chamorro N, Alarcón G. Estudio de la infección natural por *Fasciola hepatica* en Lymnaea spp. Compend Cienc Vet. 2014; 4(2):14-18. http://scielo.iics.una.py/scielo.php?pid=S2226-17612014000200003&script=sci_arttext