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Prevalence of *Fasciola hepatica* in fighting bulls breed
Prevalencia de *Fasciola hepatica* en ganado bovino de Lidia

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ABSTRACT

Fasciolosis remains a frequent parasitosis within the bovine in extensive, despite the great implantation and efficacy of fasciolicides drugs. In the present work, the prevalence of *Fasciola hepatica* has been studied for five years, analyzing 251 cattle in the fight, evaluating the presence of hepatic macroscopic lesions. In turn, its relationship with the average temperature and rainfall of the year, and describe its pathophysiological consequences during the bullfighting celebration. Methodology: it was carried out in Madrid (July-September 2013-2017). Results: n = 251 animals in the five years, 50.20 ± 2.68 evaluated per year, of which 14 had lesions, on average 2.80 ± 1.64 per year. Likewise, a total of 4 animals compatible with lesions in the five years, on average 0.80 ± 0.84 animals per year, were reviewed. The average annual temperature was 15.78 ± 0.48 °C and the average annual rainfall was 570.20 ± 102.21mm. Statistical correlation is observed between the channels with lesions and the average annual rainfall (P <0.01) and with the average annual temperature (P <0.05). Average prevalences (5.61 ± 2.82) are lower than those described by different authors, together with weather conditions compatible with the growth of the parasite and all its intermediate hosts. The study reveals that a good use of antiparasitic agents is not entirely effective in this type of farms.

Keywords: fasciolosis, temperature, pluviometry, parasite, fighting bulls and bovine.

RESUMEN

La fasciolosis sigue siendo una parasitosis frecuente dentro del bovino en extensivo, a pesar de la gran implantación y eficacia de fármacos fasciolicides. En el presente trabajo se ha estudiado durante cinco años la prevalencia de *Fasciola hepatica* analizando 251 bovinos de lidia, evaluando la presencia de lesiones macroscópicas hepáticas. A su vez, su relación con la temperatura y pluviometría media del año, y describir sus consecuencias fisiopatológicas durante el festejo taurino. Metodología: se llevó a cabo en Madrid (julio-septiembre 2013-2017). Resultados: n=251 animales en los cinco años, 50.20±2.68 evaluados al año, de los cuales, 14 presentaron lesiones, de media 2.80±1.64 al año. Asimismo, se reseñaron en el reconocimiento un total de 4 animales compatibles con lesiones en los cinco años, de media 0.80±0.84 animales al año. La temperatura media anual fue de 15.78±0.48°C y la pluviometría media anual de 570.20±102.21mm. Se observa correlación estadística entre las canales con lesiones y la pluviometría media anual (P<0.01) y con la temperatura media anual (P<0.05). Se obtienen prevalencias medias (5.61±2.82) inferiores a las descritas por diferentes autores, junto con condiciones climatológicas compatibles con el crecimiento del parásito y de todos sus hospedadores intermediarios. El estudio revela que un buen uso de los antiparasitarios no es del todo efectivo en este tipo de explotaciones.

Palabras clave: fasciolosis, temperatura, pluvimetría, parásito, toro, lidia y bovino.

INTRODUCTION

The first reference known to *Fasciola hepatica*, corresponds to an exploitation of sheep located in France, owned by Jean de Brie; which describes in 1379, a disease of sheep in which the liver rots by the consumption of ranunculaceae and breeds large flat worms. In 1774 Weinland discovers that the intermediate host was the mollusk. But it was not until 1892 when it was discovered that ruminants became infected by ingesting cystic larvae in the grass (metacercariae). In 1883 A.P. Thomas and R. Leuckart discovered the complete biological cycle, morphology and parasite biology. F. hepatica (kingdom: animalia, phylum: platyhelminthes, class: trematoda, subclass: digenea, order: echinostomide, family: fasciolidae, genus: *fasciola*, species: *F. hepatica*. Linnaeus, 1758) is a eurixene parasite, has a broad spectrum of definitive hosts; the main ones are ruminants, but it can also parasitize other mammalian vertebrates, such as: equidae, suidae, rodents, lagomorphs; even carnivores and marsupials. Also primates, and therefore man himself. It is a zoonosis, although not very prevalent in Spain and Europe; in other parts of the planet it is relatively frequent (Cordero, 1990).

Regarding the intermediate host, it is stenoxen; only in the temperate zones of the planet is it located; it acts as an intermediate host, an aquatic snail: *Lymnaea* (*Galba*) *truncatula*. *L. truncatula*, determines the existence of this process in humid areas. In the feces of ruminants infected with *F. hepatica* eggs are released into the medium, which are not embryonated; they undergo an embryo process in the environment, when the temperature and humidity conditions are adequate, in a period of time ranging from 2 to 4 weeks; they need humidity and temperatures above 10 °C. (Cordero, 1990).

The larval forms, once mature, hatch from the egg, and are called miracidia. These swim actively in the water and go to the intermediate host, penetrate through the foot muscles in the snail, and inside the following phases of the biological cycle take place, which are asexual multiplication phases: sporocysm, redia and cercaria. These phases, under optimal conditions, take about 40 days to develop. The cercariae leave the intermediate host, they swim again, heading for the vegetation that is found on the banks of flooded areas, where they are encycled; giving rise to a form of resistance called metacercaria. The metacercariae will be ingested again by the definitive host (Claridge *et al.,* 2012).

The endogenous biological cycle begins with the ingestion of metacercariae. Due to the action of body temperature, the anaerobic environment of the digestive tract and bile enzymes, the detachment of the juvenile phases of *F. hepatica* occurs; and migration begins from the duodenum, to the definitive location, the bile ducts (Rojo-Vázquez, 2012). Migration occurs from the duodenum to the abdominal cavity, and after 4-6 days after infection they reach the liver. From the abdominal cavity they cross the Glisson capsule, access the hepatic parenchyma and finally reach the bile ducts; carrying out a centripetal migration (Albuquerque *et al.,* 2013). The preparation period is 8-9 weeks.

The main presentation of fasciolosis in fighting bulls, is in a chronic clinical picture (Clery *et al.,* 1996; Forbes *et al.,* 2015). In addition, we must remember that the main aptitude of fighting cattle is based on bullfighting festivities; therefore, at this time of maximum, intense and prolonged exercise, the animal's performance should be maximum (Mulone 1986*;* Escribano*, et al* 2010; Escalera-Valente *et al* 2013).

The intense exercise to which the cattle are subjected during the celebration requires a great organic response: increased lung capacity, increased heart and respiratory rate, increased glucose availability in the bloodstream; therefore, increase of gluconeogenesis and reduction of glycogenogenesis, increase of pyruvic, butyric and lactic acid transformation; as well as activation of compensatory mechanisms of metabolic acidosis due to increased hydrogenation (Hiney, *et al* 2004). In several studies, the adaptive capacity of the fighting breed bovine to face these extreme situations is demonstrated; nevertheless, certain pathological circumstances, such as fasciolosis, which diminish their adaptive capacities, have a very negative impact on their performance at the celebration (García-Sacristán *et al.,* 1996; Cunningham, 2003). In the first place, the clinical picture produced in acute cases, can lead to defects in animal trapping, weight loss and the appearance of edema; This will have a very negative impact on the recognition of the animal prior to the celebration, since it compromises its aptitude for the fight, for not meeting the relevant morphometric characteristics (Real Decreto 60/2001, Boletín Oficial del Estado, 2001).

Chronic presentations will reduce liver functionality directly proportional to the degree of infestation of the animal; in such a way, that a reduction in hepatic activity will affect a decrease in the synthesis of plasma proteins, generally producing hypoalbuminemia, which manifests externally with the presence of edemas in declining areas, due to the extravasation of fluids from the bloodstream. In addition, the synthesis and release of liver enzymes and the hematocrit value are reduced (Da Silva *et al.,* 2017). This value, during the performance of the fight, is essential, because in the strenuous exercise performed by the animal, it needs a lot of oxygen to respond positively to metabolic needs (Kaneko *et al.,* 1997).

In addition, fasciolosis carries with it a metabolic imbalance that increases the consumption of glycogen stores, with a consequent decrease in the availability of liver and muscle glycogen; as well as fatty deposits (Pérez *et al*., 1992). All of them important in the phenomenon of gluconeogenesis, so necessary for the animal during the bullfighting show.

On the other hand, chronic lesions of *F. hepatica*, can produce peritonitis, which can be manifested during the fight with episodes of pain by the animal; as well as with reluctance to certain movements due to afflictions in the abdominal cavity (Clery *et al.,* 1996; Forbes *et al.,* 2015). Adhesions may also appear at the cranial level of the liver, along with the diaphragm; which are inversely proportional to the mobility of the diaphragm, and therefore, will negatively influence the animal's breathing and

consequently decrease the response to the intense exercise to which the cattle are subjected during the show (Marcos *et al.,* 2007; Lomillos *et al.,* 2018).

In relation to the treatment of fasciolosis, numerous studies have revealed the effect of different pharmacological groups, which have an effect on the different stages of the parasite; the most used are: nitroxynil, clorsulon, albendazole, triclabendazole and closantel (Graig y Jhuey, 1984; Mooney *et al.,* 2009).

The objective of the study was to determine the prevalence of *Fasciola hepatica* in brave cattle dealt with for five years, through the presence of macroscopic lesions in livers seen in slaughterhouses, its relationship with the average temperature and rainfall of the year, and its pathophysiological consequences that reduce the fitness of the animal during the bullfighting celebration.

MATERIAL AND METHODS

The work was carried out in the community of Madrid, in the bullfighting celebrations that took place during the months of July, August and September, from 2013 to 2017. A total of 251 channels were analyzed, in different municipalities of the community autonomous, all of them in authorized places and rooms for the skinning of the animals after the celebration (Real Decreto 260/2002, de 8 de marzo). The animals dealt with were loose cows (females between two and twelve years of age), bulls for capea (three years), bulls for bullfighting (males between four and five years of age) and steers for chopped heifers (males three years) and not chopped (two year old males).

The recognition indicates those animals that have low levels of body condition, with hirsute, dull and depigmented hair, signs compatible with chronic diseases, including fasciolosis. After the celebration, the periportal ganglia, the hepatic surface, hepatic parenchyma, bile ducts and gallbladder are analyzed in the skin. All those who presented parasitosis in situ or signs compatible with fasciolosis, such as: larval migratory pathways in the liver, hemorrhagic and with coagulative necrosis, cholangiohepatitis, cholengiectasis, thickening and fibrosis of the bile ducts, are considered as parasitized livers with F. Hepatica, see figure 1. In image A, connective tissue pathways are observed in hepatic parenchyma compatible with ancient migration of *Fasciola hepatica*, and in B and C, connective tissue pathways are observed in liver surface and parenchyma compatible with recent migration of *Fasciola hepatica*, as well as visualization of the parasite. In image B, slight fibrinous perihepatitis is also observed. The prevalence of liver disorders compatible with fasciolosis in all its clinical forms is counted, compared to those that do not present macroscopic alterations compatible with the parasite.

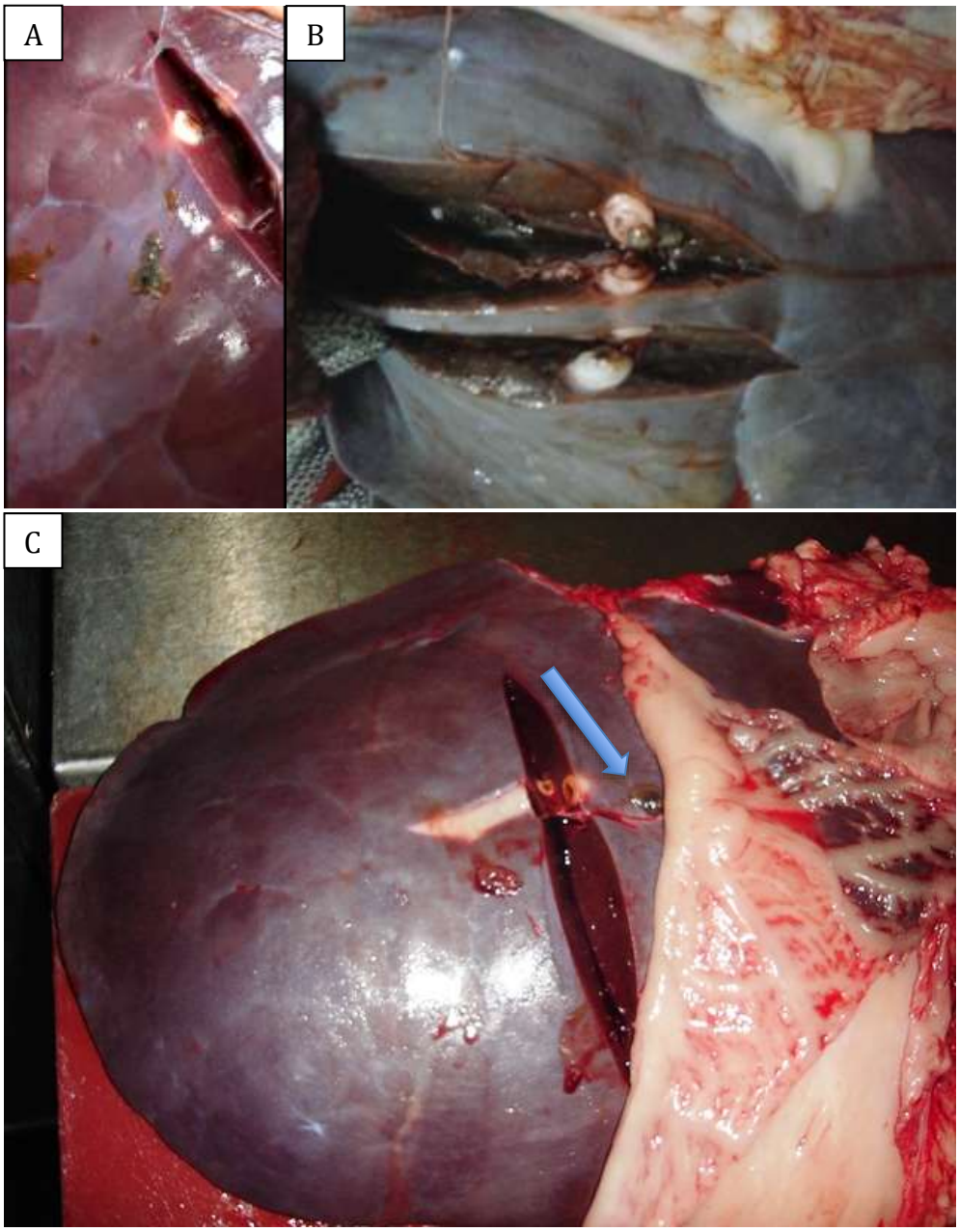

Figure 1.- Connective tissue pathways in hepatic parenchyma compatible with *Fasciola hepatica* migration, as well as visualization of the parasite

All data is collected in a computerized manner, as well as data from the State Meteorological Agency (AEMET) on annual average temperatures and rainfall. Subsequently, statistical analysis is performed with IBM SPSS Statistics Base 22.0. The distribution of the numerical variables was carried out through the t-Student analysis; while the correlation was analyzed with the Pearson correlation method.

Se recogen todos los datos informáticamente, así como se obtienen datos de la Agencia Estatal de Meteorología (AEMET) sobre temperaturas y pluviometría medias anual. Posteriormente se realiza análisis estadístico con IBM SPSS Statistics Base 22.0. La distribución de las variables numéricas fue realizada a través del análisis t-

Student; mientras que la correlación se analizó con el método de correlación de Pearson.

RESULTS

Table 1. Results obtained from the sampling of bullfighting channels in the north of the Community of Madrid during the years 2013 to 2017

Year	nº animals	nº animals with injuries in the slaughterhouse	prevalence	nº animals with compatible symptomatology	Average annual temperature (°C)	Average annual rainfall (mm)
2013	50	2	4.00% (2/50)	2	14.97	515
2014	46	4	8.69% (4/46)	1	15.96	680
2015	53	2	3.77% (2/53)	0	16.00	500
2016	52	5	9.61% (5/52)	1	15.80	682
2017	50	1	2.00% (1/50)	0	16.20	474
Mean	50.20	2.80	5.61%	0.80	15.78	570.20
Standard deviation	2.68	1.64	2.82	0.84	0.48	102.21

The total number of animals sampled was 251 in the five years, distributed in 50.20 ± 2.68 evaluated per year, within which lesions appeared in a total of 14 channels, on average 2.80 ± 1.64 per year. Likewise, a total of 4 animals compatible with lesions in total, on average 0.80 ± 0.84 animals per year, were reviewed. The average annual temperature was 15.78 ± 0.48 °C and the average annual rainfall was 570.20 ± 102.21 mm, see table 1.

The number of animals with compatible skinny lesions found does not have a statistically significant relationship with the total number of animals evaluated per year (P=0.159), nor with the animals that presented compatible symptomatology in recognition (P=0.327). On the other hand, there is statistical significance between the number of animals with compatible skinny lesions found and the average annual rainfall (P <0.01) and with the average annual temperature (P <0.05).

DISCUSSION

The prevalence of fasciolosis in dairy cattle in a study conducted in 275 herds in Galicia during 2007, revealed a prevalence data of 61.1%, without finding statistically significant differences between herds treated and not treated with different drugs (Piñeiro P, 2013).

In the present study, a prevalence of 5.61±2.82 animals with compatible lesions per year has been obtained, a figure significantly lower than the study published by Orjales *et al.,* 2017. It is worth noting the importance of the use of fasciolicidal drugs, prior to the predominant season bullfighting shows: June to September, compared to the drugs used in the previous study that were applied continuously throughout the year, in the dry period of dairy cattle. However, the effectiveness of antiparasitic treatments is dependent on the application strategy; as well as possible antiparasitic resistance should be considered (Kelley *et al.,* 2016; Beesley *et al.,* 2017).

The data that exist on fasciolosis in extensive cattle, reflect a high prevalence of the parasite (Orjales *et al.,* 2017; González-Lanza *et al.* 1989), describe in Leon a prevalence of 29.5% of infected animals, as well as a intimate relationship between prevalence and age of the animals. This relationship has significance in cattle, as Castilla-León has a high percentage of livestock cattle, and in addition, a large percentage of animals are dealt with four, five and six years old

However, it is also worth noting the climatic difference of the Spanish Cantabrian cornice, where there is less representation of cattle of fighting bulls, in relation to the climatology of the center and south peninsular, where the vast majority of cattle farms are found (Lomillos *et al.,* 2012; Painceira, 2012). The average data obtained from both temperature and rainfall were 15.78±0.48 °C and 570.20±102.21 mm respectively, which are within the ranges and standards compatible with the growth of larval, juvenile and adult phases of *F. hepatica*, as well as of all its intermediate hosts, since a favorable temperature range is established: those between 10 and 30 °C, with an optimum temperature of 27 °C. (Rowcliffe, *et al.,* 1960; García-Rodríguez *et al.,* 1985; Astiz-Blanco *et al.,* 2007). However, another study obtains the best results at a temperature of 25 °C (Diez y Rojo-Vázquez, 1976), this temperature is achieved, in the predominant area of beef cattle farms, in the spring and summer seasons. These values are endorsed by more recent studies, which evaluate the larval load in pastures throughout the year, being maximum in the spring and summer months (Nogareda *et al.,* 2006).
The results could be justified by greater rainfall in those years and high temperatures. However, one might also think that the control methods were not adequate: uncharged areas flooded on farms with access to animals, poor application of molluscicides and fasciolicides; or the existence of resistance of the same.

CONCLUSION

The prevalence (5.61±2.82) of lesions compatible with fasciolosis is still present in cattle. The years in which the highest number of injuries were found were 2014 and 2016. A thorough inspection by the veterinarian of the viscera of the postmortem cattle in the skin is pertinent, to assess the effectiveness of the antiparasitic treatments and at the same time study the possible negative effect of this parasite on the physical performance of the bull in the bullring.

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