

Scientific Paper

Hematological performance of cattle infected by trematodes in a humid warm climate of Mexico[▲]

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Abstract

Cattle husbandry in Mexico is highly important in the country's economy. In the tropic, one of the main health problems that affect production is internal parasites, which can cause economic losses due to the reduction in the weight gain of the animals. The presence of trematodes, such as *Fasciola hepatica* causes the confiscation of livers in slaughterhouses; while paramphistomids affect the optimum animal development. The objective of the study was to establish the relation between the hematological values and the presence of trematodes in cattle, in a warm humid climate of Mexico. For such purpose, feces samples were taken from 194 bovines (cows and bulls), from which a feces analysis was made. The study was conducted between October and December, 2018. From the visits to 10 production farms located in the region of the Tabasco and Chiapas states, the data with which the statistical analyses were made to determine frequency and prevalence, were obtained. As a result, the general prevalence of trematodes was 40,2 %, which corresponded to 78 infected animals from a total of 194. The presence of trematodes did not affect the hematological composition of the sampled cattle. It is concluded that, in spite of the high prevalence of trematodes in the region, the hematological values were among the normal ones indicated for cattle from tropical zones.

Keywords: *Fasciola hepatica*, Paramphistomidae, parasites

Introduction

Cattle production in Mexico is one of the main economic activities of the agricultural sector. The Mexican tropic contributes 17,14 % of the national milk production and the beef production is 34,08 % (SIAP, 2016).

However, the beef and milk production in the tropic faces problems derived from such environmental factors as extreme temperature and humidity, which favor the presence of viral, bacterial and parasitic diseases (Chávez *et al.*, 2015).

Among the internal parasites with higher prevalence trematodes stand out (González *et al.*, 2007). From them, *Fasciola hepatica* is of high economic importance because it causes estimated losses from 8 to 28 % in beef yield, besides the decrease in milk production and losses due to confiscation of livers in slaughterhouses (Torgerson, 2013). In the same group of trematodes, the family Paramphistomidae affects the gastrointestinal tract, causing, in acute cases, hemorrhagic inflammation that can swell the

mucosa and submucosa of the rumen and reticulum (Barriga, 2002). Nevertheless, the main damage is caused during the migration of juvenile stages after excystation in the small intestine, and the counter-current migration to reach the reticulum and rumen (Pavan Kumar *et al.*, 2016). The objective of this study was to establish the relation between hematological values and presence of trematodes in cattle in a warm humid climate of Mexico.

Materials and Methods

The study was conducted during October to December, 2018 (North winds season). Cattle production farms were visited in the Teapa municipality, in the Tabasco state, and in the Pichucalco and Salto de Agua municipalities, of Chiapas state, Mexico. The study zone shows a warm humid climate, with rainfall throughout the year, with a rainfall range from 2 000 to 2 500 mm and temperature range from 24 to 26 °C (INEGI, 2010).

Sampling. Blood and feces samples were taken from 194 adult bovines, from 10 farms of the region:

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185 cows under production and 9 bulls. The feces were directly taken from the animals' rectum and were later transferred to the laboratory for their analysis through the sedimentation technique. To detect the presence of trematode eggs, 10 grams of feces were used, which were processed in sieves arranged in decreasing order according to their diameter (mesh 12, 50, 100 and 400), until achieving that the sample was clean. The material recovered in the sieve with 38-micra diameter (mesh 400) was placed in graduated glass up to 100 ml of water. Afterwards, the sediment was extracted from the glass bottom with a pipette, and it was placed on a Petri dish to check the content. Three drops of concentrated lugol's iodine were applied to discriminate among eggs from *F. hepatica* (stained) and Paramphistomidae (transparent; Armstrong *et al.*, 2011).

To collect the blood samples the caudal vein was punctured, and 5 ml of blood were extracted in vacutainer tubes with EDTA. With the blood samples the hematocrit percentage was determined (Coffin, 1986), as well as the content of plasma protein with a refractometer (g/dL). For determining the peripheral eosinophils a Carpentier solution was prepared, in which the blood was diluted and the reading was performed in a Neubauer chamber; it was expressed in number of eosinophils per microliter.

Statistical analysis. The prevalence of trematodes (number of positive animals/total number of

animals) was obtained by descriptive statistics, using the SAS program (2004). For determining the effect of parasite infestation on the hematological indexes, a variance analysis was made with the GLM procedure of SAS (SAS, 2004), where the presence of internal parasites and the cattle age were included.

Results

The general prevalence of trematodes, determined through fecal egg count, was 40,21 % in adult cattle of the Tabasco and Chiapas states. On the other hand, the hematological components showed differences between the young and adult animals, but no differences were observed between the animals infected with trematodes and those diagnosed as free from these parasites (table 1). Among the categories higher values were observed in the packed cell volume (PCV), number of erythrocytes, quantity of hemoglobin (HGB), number of leukocytes, percentage of lymphocytes and mean cells in the young animals; while the plasma protein, mean cell volume (MCV), percentage of granulocytes and number of eosinophils were higher in the adult animals.

The presence of trematodes did not affect the hematological composition in the sampled cattle (table 2). The counts of erythrocytes, hematocrits and eosinophils were similar in the animals infected with trematodes to the ones which were free of parasites.

Table 1. Hematological components of young (younger than three years) and adult cattle (older than three years) in a warm humid climate.

Variable	Young cattle			Adult cattle		
	n	Mean	SE ±	n	Mean	SE ±
PP, g/dL	45	7,2 ^b	0,15	81	7,6 ^a	0,06
Erythrocytes, cells/μL	45	8,1 ^a	0,22	79	6,03 ^b	0,12
Hematocrit, %	45	31,6 ^a	0,85	79	27,6 ^b	0,51
MCV, fL	45	39,8 ^b	1,00	79	46,0 ^a	0,51
HGB, g/dL	45	10,3 ^a	0,25	79	9,7 ^b	0,18
Leukocytes, x10 ³ cells/μL)	44	14,1 ^a	0,56	79	10,3 ^b	0,38
Lymphocytes, %	44	56,1 ^a	1,44	79	47,4 ^b	1,08
Granulocytes, %	44	26,5 ^b	1,28	79	36,7 ^a	1,06
Medians, %	44	17,3 ^a	0,52	79	15,9 ^b	0,54
Eosinophils, x10 ³ cells/μL	46	0,7 ^b	0,09	81	1,2 ^a	0,10

n. number of observations, PP: plasma protein, MCV: medium cell volume; HGB: quantity of hemoglobin, fl: femtoliters (μm³). Different letters in the same row indicate significant differences (p<0,05).

Table 2. Hematological components with regards to the presence or absence of trematodes.

Variable	Presence of trematodes			Absence of trematodes		
	n	Mean	SE ±	n	Mean	SE ±
PP, g/dL	42	7,7	0,07	84	7,3	0,09
Erythrocytes, cells/ μ L	41	6,0	0,16	83	7,1	0,18
Hematocrit, %	43	28,0	0,65	84	30	0,52
MCV, fL	41	46,9	0,72	83	42,2	0,69
HGB, g/dL	41	9,9	0,23	83	9,9	0,19
Leukocytes, $\times 10^3$ cells/ μ L	41	9,9	0,37	82	12,5	0,47
Lymphocyte, %	41	45,7	1,38	82	52,9	1,14
Granulocytes, %	41	37,5	1,51	82	30,8	1,10
Medians, %	41	16,8	0,70	82	16,2	0,48
Eosinophils, $\times 10^3$ cells/ μ L	43	1,29	0,13	84	0,93	0,09

n. number of observations, PP: plasma protein, MCV: medium cell volume; HGB: quantity of hemoglobin, fl: femtoliters (μm^3). Different letters in the same row indicate significant differences ($p < 0,05$).

Discussion

In this study, the prevalence of trematodes (*F. hepatica* and Paramphistomidae) in a warm humid climate region of Mexico reached values between 0 and 61 %, with a general average of 40 %. From the 10 visited production farms, only one did not show presence of trematodes, which indicates high prevalence in the zone. Nevertheless, due to the lack of knowledge about clinical symptoms and the lack of studies regarding the impact on animal health, no importance has been ascribed to this parasites. For such reason, it is necessary to research the impact during the juvenile stage of trematodes, especially when they travel towards the rumen after excystation in the small intestine (Pavan Kumar *et al.*, 2016).

The high prevalence of trematodes has been reported in countries such as Peru, in which $10,0 \pm 2,9$ % of *F. hepatica* and $28,4 \pm 4,4$ % of individuals from the family Paramphistomidae were found (Paucar *et al.*, 2010); while Salas-Aivar (2004), in this same country, observed that the prevalence of Paramphistomidae in slaughtered cattle was 36,50 %, with maximum values of 75 %. The fluctuations in prevalence have been closely associated with the climate conditions, and the studies indicate abundance in the rainy season. In Mexico, in the Tabasco state (Jalapa, Tacotalpa and Teapa) with a warm humid climate, the prevalence of *Paramphistomum cervi* reached from 3,33 to 96,67 % throughout the year, with an average of 39,10 % (Rangel-Ruiz *et al.*, 1999). In a study in

this same zone it was observed that the prevalence of *Fasciola* and Paramphistomidae increased in the rainy months (Ojeda-Robertos *et al.*, 2014), similar to the observations made in this study during the rainy season.

In spite of the high degree of prevalence of *F. hepatica* and Paramphistomidae, influenced by the environmental conditions which favor the presence of this type of parasites in the study zone (Pinedo *et al.*, 2010), the hematological values were among the normal ones indicated for the cattle from tropical zones (González-Garduño *et al.*, 2017). Yet, it should be considered that there are other factors that affect to a higher extent the hematological composition, such as the genetic ones, physiological stage, resistance and susceptibility to hematophagous parasites, feeding and management in general, among many others.

It is concluded that, in spite of the high prevalence of trematodes in the region, the hematological values were among the normal ones for cattle in tropical zones.

More studies which allow to evaluate the damage caused by this type of parasite in young animals infected with its juvenile stages.

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Bibliographic references

- Armstrong, W. A.; Oberg, C. & Orellana, J. J. Presencia de huevos de parásitos con potencial zoonótico en parques y plazas públicas de la ciudad de Temuco, Región de La Araucanía, Chile. *Arch. med. vet.* 43 (2):127-134, 2011. DOI: <http://dx.doi.org/10.4067/S0301-732X2011000200005>.
- Barriga, O. O. *Las enfermedades parasitarias de los animales domésticos en la América Latina*. Santiago de Chile: Editorial Germinal, 2002.
- Chávez, Laura; Serrano-Martínez, E.; Tantaleán, M.; Quispe, M. & Casas, Gina C. Parásitos gastrointestinales en reptiles en cautiverio en Lima Metropolitana. *Rev. investig. vet., Perú.* 26 (1):127-134, 2015. DOI: <http://dx.doi.org/10.15381/rivep.v26i1.10909>.
- Coffin, L. *Laboratorio clínico de medicina veterinaria*. (Trad. J. Santibañez y J. Urrusti). 3 ed. México: La Prensa Médica Mexicana. p. 125-170, 1986.
- González, R.; Pérez-Ruano, M. & Brito, S. Fasciolosis bovina. Evaluación de las principales pérdidas provocadas en una empresa ganadera. *Rev. salud anim.* 29 (3):167-175, 2007.
- González-Garduño, R.; López-Arellano, María E.; Mendoza-de-Gives, P.; Arece-García, J.; Marie-Magdeleine, Carine; Torres-Hernández, G. T. *et al.* Comparative response of IgA and IgG activity and hematological parameters among four main beef-cattle breeds infected with gastrointestinal nematodes in the warm humid tropic of Mexico *Ann. Anim. Sci.* 17 (3):819-833, 2017. DOI: <http://doi.org/10.1515/aoas-2016-0089>.
- INEGI. *Compendio de información geográfica municipal 2010*. Teapa, México: Instituto Nacional de Estadística y Geografía, 2010.
- Ojeda-Robertos, Nadia F.; Medina-Reynes, Alises; Garduza-Arias, Gabriela & Rangel-Ruiz, L. J. Dinámica de excreción de huevos de *Fasciola hepatica* y *Paramphistomum* spp en ganado bovino de Tabasco. *Ecossistemas y recur. agropecuarios*. 1 (1):73-80, 2014.
- Paucar, Silvia; Chávez, Amanda; Casas, Eva & Suárez, F. Prevalencia de fascioliasis y paramfistomiasis en el ganado lechero de Oxapampa, Pasco. *Rev. investig. vet., Perú.* 21 (1):87-92, 2010.
- Pavan Kumar, C; Syaama Sundar, N. & Devi Prasad, V. Outbreak of immature paramphistomosis in Nellore Jodipi sheep. *J. Parasit. Dis.* 40 (2):533-553, 2016. DOI: <http://doi.org/10.1007/s12639-014-0541-4>.
- Pinedo, Rosa; Chávez, Amanda; Casas, Eva; Suárez, F.; Sánchez, N. & Huamán, H. Prevalencia de tremátodos de la familia Paramphistomatidae en bovinos del distrito de Yurimaguas, provincia de alto Amazonas, Loreto. *Rev. investig. vet., Perú.* 21 (2):161-167, 2010.
- Rangel-Ruiz, L. J.; Márquez-Izquierdo, R. & Bravo-Nogueira, G. Bovine fasciolosis in Tabasco, Mexico. *Vet. Parasitol.* 81 (2):119-127, 1999.
- Salas-Aivar, Liliana. *Prevalencia del parásito del rumen (Paramphistomum sp.) en bovinos sacrificados en el camal de Tingo María*. Tesis para optar el título de Ingeniero Zootecnista. Tingo María, Perú: Facultad de Zootecnia, Departamento Académico de Ciencia Animal, Universidad Nacional Agraria de la Selva, 2004.
- SAS Institute Inc. *SAS/STAT® User's Guide, Version 9.2*. 2nd ed. Cary, USA: SAS Institute Inc., 2004.
- SIAP. Índice de volumen físico agropecuario. México: Servicio de Información Agroalimentaria y Pesquera. <https://datos.gob.mx/busca/dataset/indice-de-volumen-fisico-agropecuario>, 2016.
- Torgerson, P. R. One world health: socioeconomic burden and parasitic disease control priorities. *Vet. Parasitol.* 195 (3-4):223-232, 2013. DOI: <http://doi.org/10.1016/j.vetpar.2013.04.004>.

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