Prevalence of gastrointestinal parasites in pre-slaughter cattle in the municipality of Quevedo, Ecuador

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Recibido: 10/09/2024 Aprobado: 18/10/2024

ABSTRACT

This study aimed to assess the prevalence of gastrointestinal parasites in pre-slaughter cattle at the Quevedo abattoir, Ecuador. A total of 240 fecal samples were collected between August 2022 and July 2023. Variables such as age, sex, origin of the cattle, and season were analyzed to identify potential risk factors associated with parasite presence. Parasite identification was conducted using the flotation technique, which revealed the presence of *Strongyloides* and *Paramphistomum*. Statistical analysis involved calculating the Odds Ratio (OR) to assess exposure to risk factors, while the Chi-square test evaluated associations between variables and prevalence rates. Infection was significantly associated with male sex and animals originating from the Pucayacu area, attributed to the high humidity characteristic of this region. The overall parasite prevalence exceeded 50%, underscoring the need for implementing control measures in high-risk areas. Data analysis was performed using the statistical software InfoStat.

Keywords: risk factor, *Strongyloides*, *Paramphistomum*.

Prevalencia de parásitos gastrointestinales en bovinos pre-faenado en el municipio de Quevedo, Ecuador

RESUMEN

Este estudio tuvo como objetivo evaluar la prevalencia de parásitos gastrointestinales en bovinos pre-faenados en el camal de Quevedo, Ecuador. Se analizaron 240 muestras fecales recolectadas entre agosto de 2022 y julio de 2023. Se consideraron como variables la edad, el sexo, el lugar de procedencia del bovino y la época del año para identificar posibles factores de riesgo asociados a la presencia de parásitos. La identificación de las noxas se realizó mediante la técnica de flotación, lo que reveló la presencia de *Strongyloides* y *Paramphistomum.* El análisis estadístico incluyó el uso del Odds Ratio para determinar la exposición a factores de riesgo y la prueba de Chi cuadrado evaluó la asociación entre variables, además de la prevalencia. La infección estuvo significativamente asociada con el sexo macho y la procedencia de los animales de la zona de Pucayacu, por la alta humedad que caracteriza a la región. La prevalencia de parásitos fue superior al 50%, lo que resalta la importancia de efectuar medidas de control en estas áreas de mayor riesgo. El procesamiento de los datos se llevó a cabo con el *software* estadístico InfoStat.

Palabras clave: factor de riesgo, S*trongyloides, Paramphistomum*.

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INTRODUCTION

In Latin America, livestock farming plays a pivotal role due to the substantial availability of productive land, serving as a significant source of employment and nutrition across various social strata (Carizi *et al.* 2019). However, the expansion of the livestock sector has heightened the risk of disease, driven by anthropogenic changes that increase interactions among wildlife, humans, and livestock (Rodríguez *et al.* 2016).

The presence of endoparasites in cattle is a common issue, adversely affecting productivity and health, and leading to considerable economic losses (Pineda *et al.* 2018; Abdala *et al.* 2020). Proper identification and management of parasitic loads in cattle are essential to mitigate and prevent the negative impacts of parasitism (Samaniego *et al.* 2022).

Parasitic control in ruminants, especially against nematodes, predominantly relies on the frequent use of anthelmintics. However, indiscriminate and epidemiologically unsound use of these drugs has resulted in widespread parasite resistance (Leal *et al.* 2019). To maximize livestock productivity, understanding the epidemiology of gastrointestinal parasites specific to each region is crucial, as these parasites directly affect the health, production, and reproductive performance of cattle (Nastasi 2015).

The relevance of this research lies in its contribution to the existing scientific knowledge concerning the threat posed by parasites to livestock productivity and animal welfare. Despite the importance of this issue, most existing studies have focused on broader geographical areas or other provinces, limiting the understanding of local epidemiological conditions. Therefore, this study aimed to evaluate the prevalence of gastrointestinal parasites in pre-slaughter cattle at the municipal abattoir of Quevedo, Ecuador, providing specific and relevant data for this region and enhancing the understanding of the local epidemiological situation.

MATERIALS AND METHODS

The study was conducted at the municipal abattoir of Quevedo, located in the San Camilo parish at 1° 20' 30" S latitude and 79° 28' 30" W longitude, with an elevation of 69 m above sea level. The meteorological conditions of the area are characterized by an average temperature of 24 °C, relative humidity of 85%, and an annual rainfall of 2,224 mm. Coproparasitological analyses were carried out in the Microbiology Laboratory of the State Technical University of Quevedo, situated at the Experimental Farm La María, 7.5 km along the Quevedo-El Empalme road, Los Ríos Province, at 1° 3' 18" S latitude and 79° 25' 24" W longitude, with an elevation of 73 m above sea level.

Ethical considerations

The study did not require approval from an ethics committee, as no experiments were performed on the animals. However, the ethical compliance certificate with reference number CERT-ÉTICA-003-DICYT-2024, issued by the Research Directorate of Universidad Técnica Estatal de Quevedo, confirms that this *in situ* research adhered strictly to animal welfare guidelines. Throughout the study, all procedures ensured that cattle were never subjected to cruelty, in full compliance with the Organic Animal Welfare Law (LOBA) in Ecuador, as stipulated in Article 585 of the Ecuadorian Civil Code. The study focused exclusively on observational data

collection, maintaining adherence to established legal and ethical standards for animal welfare in Ecuador.

Sample selection

In 2021, the municipal abattoir of Quevedo had an annual average of 6,430 slaughtered cattle. The sample size was calculated using the formula: $n = N \cdot z^2 \cdot p \cdot q / e^2 (N - 1) + z^2 \cdot p \cdot q$, with a 95% confidence coefficient. A total of 240 cattle were randomly selected for the study (Aguilar, 2005).

Sample collection

Fecal samples were collected directly from the rectum of the animals using palpation sleeves, obtaining approximately 10 g per sample, which were placed in sterile plastic containers. Information on sex, age, origin, and season of the year for each animal was recorded. The samples were then stored in thermal containers and transported to the UTEQ laboratory for processing and evaluation (Caro *et al.* 2011).

Coproparasitological flotation analysis

To perform the flotation technique (Petters *et al.* 2019), a saturated saline solution was prepared by dissolving 250 g of sugar and 200 g of sodium chloride in 500 mL of distilled water. A 4 g fecal sample was weighed and mixed with 57 mL of the solution in a sterilized container. The mixture was gently stirred and strained through a sieve into another sterile container. Using a pipette, the suspension was transferred into a test tube until a convex meniscus formed. A coverslip was placed on top, and the sample was allowed to stand for 5 minutes to enable parasite eggs to float to the surface. The eggs were then examined under a microscope at 10X and 40X magnification, with identification based on morphological characteristics (Pinilla *et al.* 2019).

Prevalence determination

Prevalence was calculated based on sex, age, origin, and season using the formula: Prevalence = (Number of positive animals / Number of animals sampled) × 100 (Guamán et al. 2021).

Odds Ratio determination

Statistical analysis included the calculation of the Odds Ratio (OR) to quantify the association between exposure to risk factors and outcomes such as parasitic infection. This measure identified the most significant factors contributing to parasite transmission, with values greater than 1 indicating an increased likelihood of infection. Variables such as age, sex, origin, and season were analyzed to determine the factor most closely associated with parasite presence in cattle (Solis *et al.* 2022).

Statistical analysis

Statistical analyses were performed using InfoStat software, employing the Chi-square test at a 95% confidence level to evaluate the association between variables and parasite presence. Pearson's Phi coefficient, Cramér's V, and the contingency coefficient were used to assess the strength of relationships between variables when no significant associations were detected. These coefficients provided a measure of the relationship strength, with values close to 1 indicating a strong association and values near 0 suggesting no significant relationship. This multifaceted approach ensured a comprehensive and accurate analysis of the risk factors associated with parasitic infections in pre-slaughter cattle.

RESULTS

Identification of gastrointestinal parasite eggs using the coproparasitological flotation method. The coproparasitological analysis enabled the specific identification of infective larvae in the fecal samples. Out of the 240 cattle examined, 160 tested positive for gastrointestinal parasites, while 80 tested negative (table 1).

Classification of gastrointestinal parasite eggs

Direct microscopic observation of the samples confirmed the presence of parasite eggs in the cattle. It was determined that 150 samples were positive for *Strongyloides* and 47 for *Paramphistomum* (table 2).

Prevalence of *Strongyloides* across variables and risk factor determination

Table 3 shows a higher prevalence of *Strongyloides* infection (76.92%) in cattle aged 5 years, with an OR of 2.07 (95% CI: 0.55-7.74). Although parasitism was observed across all age groups, the infection intensity for cattle aged 5 years had a frequency of 0.07, which did not represent a significant risk factor. The prevalence of *Strongyloides* was significantly higher

TABLE 1. Identification of eggs of gastrointestinal parasites in cattle

Cases	Number of cases	%
Positive	160	66.6
Negative	80	33.3
Total	240	100

Source: own elaboration.

TABLE 2. Classification of eggs of gastrointestinal parasites in cattle

	Results		Total cattle
Strongyloides	Positive	150	240
	Negative	90	
	Total	240	
Paramphistomum	Positive	47	240
	Negative	193	
	Total	240	

Source: own elaboration.

TABLE 3. Prevalence of *Strongyloides* in relation to age

Age (year)	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
2	77	41	0.27	53.25	0.05	0.56	0.32-0.98
3	99	62	0.41	62.63	0.05	1.01	0.59-1.72
4	51	37	0.25	72.55	0.05	1.78	0.90-3.51
5	13	10	0.07	76.92	0.05	2.07	0.55-7.74
TOTALS	240	150		62.50			

P: statistical significance OR: Odds ratio

IC: Confidence interval

Source: own elaboration.

in male cattle, with an infection rate of 67.5% compared to 52.5% in females. The OR for males was 1.88 (95% CI: 1.08-3.26), indicating that being male nearly doubled the risk of infection with this parasite (table 4).

Association between month and *Strongyloides* presence

Regarding the association between infection prevalence and month, the prevalence varied from 50% to 80% throughout the year. Notably, February had the highest prevalence at 80%. The OR for February was 31.20 (95% CI: 9.66-100.74), indicating that this month represented a significantly higher risk factor compared to the others (table 5).

Prevalence of *Strongyloides* Based on the Place of Origin

Table 6 presents the prevalence of *Strongyloides* according to the place of origin of the cattle. The prevalence in animals

TABLE 4. Prevalence of *Strongyloides* in relation to sex

Sex	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
Male	160	108	0.72	67.50	0.05	1.88	1.08-3.26
Female	80	42	0.28	52.50	0.05	0.53	0.31-0.92
TOTALS	240	150		62.50			

Source: own elaboration.

TABLE 5. Prevalence of *Strongyloides* in relation to time of year

Months	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
August	20	11	0.07	55.00	0.05	0.71	0.28-1.79
September	20	11	0.07	55.00	0.05	0.71	0.28-1.79
October	20	11	0.07	55.00	0.05	0.71	0.28-1.79
November	20	10	0.066	50.00	0.05	0.57	0.23-1.43
December	20	11	0.07	55.00	0.05	0.71	0.28-1.79
January	20	12	0.08	60.00	0.05	0.89	0.35-2.27
February	20	16	0.11	80.00	0.05	31.20	9.66-100.74
March	20	13	0.09	65.00	0.05	1.13	0.43-2.93
April	20	13	0.09	65.00	0.05	1.13	0.43-2.93
May	20	15	0.1	75.00	0.05	1.89	0.66-5.39
June	20	14	0.093	70.00	0.05	1.44	0.53-3.90
July	20	13	0.09	65.00	0.05	1.13	0.43-2.93
TOTALS	240	150		62.50			

Source: own elaboration.

from Santo Domingo and Quevedo was not statistically significant. However, cattle from Pucayacu exhibited a prevalence of 80.73%. The calculated OR for this region was 4.66 (95% CI: 2.59-8.39), indicating that Pucayacu poses a nearly fivefold higher risk of infection with this parasite compared to the other locations assessed.

Prevalence of *Paramphistomum* across variables and risk factor determination

The highest prevalence related to age was observed in 4-year-old cattle (25.49%). However, no age group was identified as a risk factor since the OR were close to 1, and the confidence intervals included the unit, indicating no significant association between age and the presence of the parasite (table 7).

Association between sex and *Paramphistomum*

Data analysis revealed that the prevalence of *Paramphistomum* was higher in females (20%) compared to males (19.38%), with OR of 1.04 and 0.96, respectively, indicating that sex is not a significant factor influencing the presence of this parasite (table 8).

TABLE 6. Prevalence of *Strongyloides* in relation to place of proceeding

Place	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
Pucayacu	109	88	0.59	80.73	0.05	4.66	2.59-8.39
Santo Domingo	126	60	0.4	47.62	0.05	0.24	0.14-0.43
Quevedo	5	2	0.01	40.00	0.05	0.39	0.06-2.39
TOTALS	240	150		62.50			

Source: own elaboration.

TABLE 7. Prevalence of *Paramphistomum* in relation to age

Age (year)	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
2	77	15	0.32	19.48	0.05	0.99	0.50-1.96
3	99	18	0.38	18.18	0.05	0.86	0.45-1.65
4	51	13	0.28	25.49	0.05	1.56	0.75-3.24
5	13	1	0.02	7.69	0.05	0.33	0.04-2.59
TOTALS	240	47		19.58			

Source: own elaboration.

TABLE 8. Prevalence of *Paramphistomum* in relation to sex

Sex	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
Male	160	31	0.66	19.38	0.05	0.96	0.49-1.89
Female	80	16	0.34	20.00	0.05	1.04	0.53-2.04
TOTALS	**240**	**47**		**19.58**			

Source: own elaboration.

Prevalence of *Paramphistomum* over the year

As shown in table 9, the months of October, November, and December exhibited the highest prevalence rates compared to the rest of the year, with OR ranging from 3.92 to 10.16, indicating a significant risk factor during these months.

Prevalence of *Paramphistomum* based on place of origin

Table 10 shows that cattle from Pucayacu exhibited the highest prevalence (29.36%) and an OR of 3.21 (95% CI: 1.63-6.33), indicating that this geographical area posed a threefold higher risk for *Paramphistomum* infection.

TABLE 9. Prevalence of *Paramphistomum* in relation to time of year

Months	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
August	20	0	0.00	0.00	0.05	0.00	0.00
September	20	0	0.00	0.00	0.05	0.00	0.00
October	20	12	0.25	60.00	0.05	7.93	3.02-20.81
November	20	9	0.19	45.00	0.05	3.92	1.52-10.11
December	20	13	0.28	65.00	0.05	10.16	3.78-27.31
January	20	7	0.15	35.00	0.05	2.42	0.91-6.46
February	20	6	0.13	30.00	0.05	1.87	0.68-5.16
March	20	0	0.00	0.00	0.05	0.00	0.00
April	20	0	0.00	0.00	0.05	0.00	0.00
May	20	0	0.00	0.00	0.05	0.00	0.00
June	20	0	0.00	0.00	0.05	0.00	0.00
July	20	0	0.00	0.00	0.05	0.00	0.00
TOTALS	240	47		19.58			

Source: own elaboration.

TABLE 10. Prevalence of *Paramphistomum* in relation to the place of proceeding

Place	Total	Positive	Frequency	Prevalence (%)	P	OR	IC
Pucayacu	109	32	0.68	29.36	0.05	3.21	1.63-6.33
Santo Domingo	126	15	0.32	11.90	0.05	0.35	0.18-0.68
Quevedo	5	0		0.00	0.05	0.00	0.0
TOTALS	240	47		19.58			

Source: own elaboration.

DISCUSSION

The parasites with the highest prevalence identified in this study were *Strongyloides* and *Paramphistomum*. This finding aligns with the reports by Samaniego *et al*. (2022), who investigated the prevalence of gastrointestinal and pulmonary parasites in Ecuador and determined that the infection levels were attributed to parasites such as *Cooperia* spp., *Trichuris* spp., *Ostertagia* spp., *Haemonchus* spp., *Strongyloides*, *Eimeria* spp., *Fasciola*, and *Dictyocaulus*. They noted that livestock could be affected by multiple parasites, which limit their zootechnical performance through direct impacts on health and productivity or indirectly by increasing prevalence due to associated risk factors.

Pinilla *et al.* (2019) indicated a correlation between age and the intensity of *Strongyloides* infection, with higher rates observed in animals younger than one year, decreasing with age due to transmission pathways that favor greater infection rates in calves under poor hygienic conditions. However, in this study, the animals were aged between two and five years, possessing a more developed immune system, and no significant differences in infection rates were observed across age groups. This contrasts with the findings of Benavides and Polanco (2017), who reported that the immune response against gastrointestinal nematodes matures with the age of the livestock, thus indicating that no age group is considered a risk factor. Nonetheless, this should be viewed as a protective factor against infections, which may arise from poor hygiene and sanitary practices in cattle herds.

Regarding the prevalence of *Strongyloides* in relation to sex, male cattle exhibited greater susceptibility to infection. Patiño *et al.* (2017) suggested that this increased predisposition in males' results from physiological and behavioral differences, as males typically have greater body mass, food intake, and metabolic rates, which increases their exposure to infective larvae during grazing. Additionally, *Strongyloides* can survive throughout the year in the environment as infective larvae, enabling them to maintain their prevalence regardless of changing environmental conditions. This is consistent with the findings of Pinilla *et al.* (2019), who did not observe significant seasonal variations in the presence of these intestinal parasites throughout the year. Unlike other parasites, such as *Eimeria* spp., the presence of *Strongyloides* remained constant over the months sampled and was not influenced by the timing of the sampling. Both studies demonstrated that the prevalence of these nematodes in cattle did not exhibit seasonal variation correlated with the months of the year.

Pucayacu, characterized by a humid climate with temperatures averaging 20 °C, represents a significant risk factor for *Strongyloides* infection, particularly when compared to Quevedo and Santo Domingo, which have temperatures of 24 °C and 23 °C, respectively. Munguía *et al.* (2021) suggest that geographic origin is a determining factor in the transmission of these parasites, as certain environmental attributes, such as humidity and favorable conditions for the development of infective larvae, facilitate the infection of new hosts and the continuation of the life cycle. Their findings indicate that more humid environments enhance the survival and availability of infective forms of *Strongyloides*, thereby increasing the risk of infection in cattle from these regions.

The results of the current study demonstrated that the presence of *Paramphistomum* is not significantly associated with the age

of the cattle, suggesting that all age groups are equally exposed to infection. However, Andrade *et al.* (2020) reported a higher incidence of positive cases in cattle under four years of age, positing that developing cattle are more susceptible to infection and subsequently acquire a degree of immunity that protects them from reinfection. Nonetheless, even adult cattle may harbor small quantities of infective larvae, which aligns with the current study's findings regarding prevalence.

Despite this correlation, the odds ratio analysis revealed that age does not act as a risk factor; rather, it may be considered a protective factor. Therefore, control and prevention strategies should be uniformly implemented across all age groups of cattle.

The low intensity of *Paramphistomum* infection in relation to sex and age is attributed to the fact that this infection is more closely related to seasonal environmental conditions than to individual factors such as age or sex. The findings suggest that variations in prevalence are more influenced by specific environmental factors related to the time of year than by the individual characteristics of the cattle. Consequently, control strategies should focus on mitigating the environmental conditions that favor the spread of the parasite, rather than concentrating on variables such as age or sex (Arroyo *et al.* 2022).

Regarding geographic origin, it was observed that cattle from certain regions exhibit greater exposure to infectious agents due to climatic and management factors (Casado *et al.* 2020). These variations in ecological and environmental conditions among tropical regions influence the presence and proliferation of intermediate hosts of the parasite. Fluctuations in climate, such as humidity and seasonal temperatures, along with region-specific management practices, create environments that may promote the development and survival of parasites, thus increasing cattle exposure to infections (Arroyo *et al.* 2022).

The prevalence percentages of *Paramphistomum* significantly increased during the rainy season. In months with abundant rainfall, higher infection levels were detected compared to the dry season. According to Baquero *et al.* (2022), environmental conditions during the winter months, including temperature, humidity, and precipitation, promote the presence of intermediate hosts of *Paramphistomum*, thereby enhancing its biological cycle and facilitating transmission.

CONCLUSIONS

Parasitic load was identified using the flotation technique, which successfully detected intestinal parasite eggs in 66.6% of the examined cattle. Infections caused by *Strongyloides* and *Paramphistomum* were identified. The infection with *Strongyloides* exhibited a significant association with both the sex of the animals and their geographic origin, indicating that male cattle and those from certain regions represent risk factors. In contrast, the infection by *Paramphistomum* showed a slight association with age, being more prevalent in cattle under four years old, while geographic origin and the time of year were considered significant risk factors for this infection.

CONFLICT OF INTEREST

The authors of this article declare that there are no conflicts of interest related to the conduct of the study and the preparation of the manuscript.

ACKNOWLEDGMENTS AND FUNDING SOURCES

We wish to express our deep gratitude to the Technical State University of Quevedo and the team at the Laboratory of Biology and Microbiology for their crucial support in conducting this study. Their collaboration and assistance were essential for the development of this research, providing the necessary resources and environment for the experiments and analyses performed. We particularly appreciate their commitment and professionalism, which have been fundamental in achieving the objectives of this work.

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

We declare that no artificial intelligence has been used in the preparation of this article.

REFERENCES

Abdala AA, Larriestra AJ, Signorini M. 2020. Estimación de pérdidas económicas causadas por *Trypanosoma vivax* en un rodeo lechero de Argentina. Rev. Vet. 31(2):115-119. http://dx.doi.org/10.30972/vet.3124728

Aguilar S. 2005. Fórmulas para el cálculo de la muestra en investigaciones de salud. Salud en Tabasco. 11(1-2):333-338. Available in: https://www.redalyc.org/articulo.oa?id=48711206

Andrade RJ, Tarazona LE, Vargas JC. 2020. Prevaléncia de tremátodos y algunos factores de riesgo en vacas lecheras en Paipa, Boyacá (Colombia). Rev. Med. Vet. Zoot. 67(3):205-218. https://doi.org/10.15446/rfmvz.v67n3.93928

Arroyo MI, Gómez L, Hernández, C, Agudelo D, Galván AL, Velásquez LE. 2022. Prevalencia de *Fasciola hepatica* y *Paramphistomidae* en bovinos de doble propósito en una hacienda del trópico bajo andino colombiano. Rev. Med. Vet. Zoot. 69(1):19-32. https://doi.org/10.15446/rfmvz.v69n1.101530

Baquero F, Díaz B, Vinueza P. 2022. Estudio de la neosporosis en bovinos de la provincia de Chimborazo, Ecuador. Rev. Inv. Cs. Agro. y Vet. 6(17):224-238. https://doi.org/10.33996/revistaalfa.v6i17.163

Benavides E, Polanco N. 2017. Epidemiología de hemoparásitos y endoparásitos en bovinos de zonas de reconversión ganadera en La Macarena (Meta, Colombia). Rev. Med. Vet. 34(1):115-136. https://doi.org/10.19052/mv.4260

Carizi V, Garzón JP, Alvarado JP, Marini PR. 2019. Condición corporal y su relación con producción láctea, reproducción y perfil metabólico en vacas lecheras del trópico boliviano. Rev. Inv. Vet. Perú. 30(1):107-118. http://dx.doi.org/10.15381/rivep.v30i1.14459

Caro NL, Carvajal MY, Jiménez L, García DJ, Pulido MO, Andrade RJ. 2011. Determinación de *Cysticercosis* en porcinos de traspatio en el municipio de Firavitoba, Boyacá. Rev. Colom. Cienc. Pecua. 24(3). Available in: http://www.scielo.org.co/pdf/rccp/v24n3/v24n3a31.pdf

Casado E, González M, Díaz A, Gutiérrez Z, Madera J, Arenal A. (2020). Desempeño de McMaster y Mini-Flotac en el diagnóstico de *Paramphistomum* spp. en bovinos. Rev. Prod. Anim. 32(1). Available in: http://scielo.sld.cu/pdf/rpa/v32n1/2224-7920-rpa-32-01-100.pdf

Guamán FS, Guerrero AE, Rojas BS. 2021. Prevalencia de parásitos gastrointestinales en porcinos faenados. Rev. Arbitr. Interdiscip. Koinonía. 6(12):553-565. https://doi.org/10.35381/r.k.v6i12.1380

Leal L, Robson E, Almeida G, Vasconcelos V, Leite E, Mendes L, Franca I. 2019. Control de la helmintiasis en becerros criados en una región semiárida cálida de Brasil. Rev. Mex. de Cienc. Pecu. 10(1):30-51. http://dx.doi.org/10.22319/rmcp.v10i1.4597

Munguía J, Leal I, Muñoz J, Medina M, Reyna J, López P. 2021. Frecuencia de parásitos gastrointestinales en bovinos del sur de Sonora, México. Abanico Vet, 9:1-11. https://doi.org/10.21929/abavet2019.919

Nastasi JA. 2015. Prevalencia de parasitosis intestinales en unidades educativas de ciudad Bolívar, Venezuela. Rev. Cuid. 6(2):1077-1084. http://dx.doi.org/10.15649/cuidarte.v6i2.181

Patiño BE, Baldrich NE, Malambo MA, Parra WD, Ortiz LM, Patiño A. 2017. Reporte de parasitosis gastrointestinales y equinos positivos a anemia infecciosa equina en la brigada de salud animal en el año 2014 en el municipio de Florencia-Caqueta. REDVET. 18(9):1-10. Available in: https://www.redalyc.org/articulo.oa?id=63653009050

Petters J, Vital C, Batista L, Gatica A, Martínez J, Abarca N, Escárcega A. 2019. Prevalencia y carga parasitaria invernal en heces de *Canis latrans* (coyote) del área natural protegida médanos de Samalayuca México. Compend. Cienc. Vet. 9(2):11-17. https://doi.org/10.18004/compend.cienc.vet.2019.09.02.11-17

Pineda JC, Flórez P, Sierra M, Morales E, Sierra R, Vásquez MC, Ortiz D. 2018. Prevalencia del parasitismo gastrointestinal en bovinos del departamento Cesar, Colombia. Rev. Inv. Vet. Perú. 29(1):278-287. http://dx.doi.org/10.15381/rivep.v29i1.14202

Pinilla JC, Uribe N, Flórez AA. 2019. *Fasciola hepatica* y otras parasitosis gastrointestinales en bovinos de doble propósito del municipio Sabana de Torres, Santander, Colombia. Rev. Investig. Vet. Perú. 30(3):1240-1248. http://dx.doi.org/10.15381/rivep.v30i3.16607

Rodríguez D, Anríuez G, Riveros JL. 2016. Food security and livestock: The case of Latin America and the Caribbean. Cien. Inv. Agr. 43(1):5-15. http://dx.doi.org/10.4067/S0718-16202016000100001

Saldivia MA, Espinoza EJ, Figueroa NF, Delgado M, Droppelmann A. 2022. Diagnóstico de parasitosis gastrointestinal en ganado vacuno de razas carniceras con diferentes técnicas coproparasitológicas. Rev. Med. Vet. Zoot. 69(3):259-267. https://doi.org/10.15446/rfmvz.v69n3.103806

Samaniego ES, Condolo LA, Vimos CF, Vinueza P, Borja B. 2022. Prevalencia de parásitos gastrointestinales y pulmonares en bovinos del cantón Guamote-Ecuador. Dom. Cien. 8(3):1086-1102. https://doi.org/10.23857/dc.v8i3.2857

Solis J, Gaxiola S, Enríquez I, Portillo J, López G, Castro N. 2022. Factores ambientales asociados a la prevalencia de *Haemonchus* spp. en corderos de la zona centro de Sinaloa. Abanico Vet. 11:1-14. https://doi.org/10.21929/abavet2021.41

Forma de citación del artículo:

Espinoza, M. A., Batista, A. R., Mariscal, S. P., & Rodríguez, V. F. (2024). Prevalence of gastrointestinal parasites in pre-slaughter cattle in the municipality of Quevedo, Ecuador. Rev. Med. Vet. Zoot. 71(3): e116553. https://doi.org/10.15446/rfmvz.v71n3.116553