Colegio de Postgraduados

Prevalence of productive impact diseases in cattle in Gomez Farias County, Jalisco, Mexico

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ABSTRACT

Objective: To estimate the incidence of productive impact diseases in San Andrés Ixtlán, Gómez Farías county, Jalisco, México; through the monthly collection from clinical cases data, attended from January 2019 to January 2020, in seven smallholders dairy farms.

Design/Methodology/Approach: Seven different smallholder livestock production units, mainly semi-stalled dairy cows, were monitored from January 2019 to January 2020, To calculate the frequency of the disease, the prevalence rate (PR) and the cumulative incidence rate (CIR) were determined, through the following equations: PR=(Total cases in a population at a given place and time / Total population at that place and given time)$\times 10^n$ and CIR=(Number of new cases in period and place / Total population at the beginning of the period in that place)$\times 10^n$

Results: According to 184 clinical cases, the metabolic diseases (21.20%) showed the highest PR, followed by parasitic (14.67%), bacterial (13.04%) and trauma (7.07%). For the CIR, diseases caused by gastrointestinal parasites (12%), showed the highest incidence, followed by mastitis (6%) and in third place malnutrition (5%). Gastrointestinal parasites of the genus *Moniezia* spp. (27.27%) and *Trichuris* spp. (4.55%) were found with higher and lower prevalence, respectively.

Study Limitations/Implications: The lack of information from regional studies that describe the productive impact diseases faced by smallholders dairy farm in the different regions of the state of Jalisco.

Findings/Conclusions: It is concluded that the most frequently problems are metabolic, followed by infestations by gastrointestinal parasites, especially those of the genus *Moniezia* spp.

Keywords: Cattle, metabolic problems, parasites.

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INTRODUCTION

In Mexico, produced 2,081,261 million tons of beef meat (SIAP, 2022) and 12,563,699 million litter of milk, with a dairy cow inventory of 2.3 million of heads in 2020 (SIAP, 2022). At the national level, Mexico has a cattle inventory of 35,224,960 heads, the country is recognized for being part of the top 10 of countries that produce cattle in the world, where Veracruz has the first place in cattle production with 4,386,162 heads and in second place the state of Jalisco with 3,326,573 of cattle heads (SIAP, 2022).

Therefore, the livestock sector must be aware of the different diseases that could be a challenge for its production. Metabolic disorders are a group of diseases, generally due to poor nutritional management that can affect cattle at any productive stage, such as ketosis, hypocalcemia and downer cow syndrome, which affect dairy cows immediately after calving. These disturbances in the metabolism of cows cause serious economic losses in terms of strong reduction in milk production and reproductive problems. It is estimated that the effects of these diseases are of great importance to evaluate the costs-benefits of diagnosis, treatment, and preventive medicine (Senthilkumar *et al.*, 2013). There is also a relationship between the incidence of metabolic diseases and nutritional disorders such as displaced abomasum, hypocalcemia and hypomagnesemia, ketosis and others such as mastitis; and reproductive problems such as placental retention and metritis, (Correa & Carulla, 2009), in some cases disorders such as tympany and rumen acidosis can be caused by ignorance in the handling of feed ingredients such as soymeal and ground corn, respectively, by producers mainly in small semi-stalled farms (Alfonso-Ávila *et al.*, 2012).

Also, gastrointestinal parasites, such as *Haemonchus* spp., *Cooperia* spp., *Trichostrongylus* spp., *Oesophagostomum* spp. and *Ostertagia* spp., cause estimated economic losses for the Mexican livestock industry calculated at US $ 445,096,562, while the losses due to *Eimeria* spp., amount to US $ 23,781,491 (Rodríguez-Vivas *et al.*, 2017), so the diseases caused by these parasites represent a great challenge for producers.

In the same way, diseases that are caused by virus, like the case of infectious bovine rhinotracheitis (IBR), which is associated with retained placenta (Montiel-Olguín *et al.*, 2019) and the bovine viral diarrhea virus (BVDV), bacterial infections such as brucellosis, leptospirosis and infections by *Staphylococcus* spp. and coliforms, which also have an incidence and distribution in livestock herds in Mexico, with a great impact on the productive and reproductive indicators, and also economic by the livestock herds holders (Castañeda-Vázquez *et al.*, 2013; Gutiérrez-Hernández *et al.*, 2020).

Therefore, the aim of this study was to estimate the incidence of productive impact diseases and the prevalence rate of gastrointestinal parasites in semi-stalled dairy cows in San Andrés Ixtlán, Gómez Farías Municipality, Jalisco; by collecting data from clinical cases attended from January 2019 to January 2020.

MATERIALS AND METHODS

Location and production data of the herds of the study site

This study was carried out in San Andrés Ixtlán, Gómez Farías county, Jalisco, Mexico. This place is the second most populous in the county, representing 35.1% of the total population of the county (16,431 habitants). It has a local livestock association; however, it does not have an updated record of the livestock heads or livestock holders in the county, neither by locality nor by county, but, according to SIAP (SIAP 2022), the county reported an annual production of 932.79 tons of live cattle (IIEG, 2022).

San Andrés Ixtlán is located at 1551 meters above sea level, with a semi-warm and semi-humid weather, the average annual temperature is 16.1 °C, while its average maximum and minimum oscillate between 27.2 °C and 4.1 °C, respectively. The average annual rainfall is 1,174 mm. The dominant land use in the county is forest occupying 55.4%.

(IIEG, 2022). Seven different smallholder livestock production units, mainly semi-stalled dairy cows, were monitored, and data from 184 clinical cases were collected from January 2019 to January 2020, with the intention of estimating the incidence and prevalence of diseases present in the region.

Diagnostic tests

In cows that presented constant weight loss, diarrheal syndrome, shaggy hair, pale gums (anemia) and sunken eyes, in addition to taking their clinical history, feces samples were collected from each animal and a coproparasitoscopic test was performed in the Microbiology Laboratory of the Centro Universitario del Sur of the University of Guadalajara, the flotation method with sucrose solution as described by Sixtos (2011), were conducted to make a diagnosis.

For the parasite identification, the table of gastrointestinal parasites in cattle and sheep from the Bayer Laboratory was used, as well as the identification table of coprological research of domestic animals from the Chinoin Laboratory (Mexico), particularly in cattle.

Study design

To calculate the frequency of the disease (FD), the prevalence rate (PR) and the cumulative incidence rate (CIR) were determined, through the following equations described by Martínez (2010):

$$PR=(\text{Total cases in a population at a given place and time} / \text{Total population at that place and given time})\times 10^{n}$$

$$CIR=(\text{Number of new cases in period and place} / \text{Total population at the beginning of the period in that place})\times 10^{n}$$

RESULTS AND DISCUSSION

During the period covered by this study, a total of 184 cattle were diagnosed, only 106 of them presented clinical problems attributed to various etiological agents, representing a population prevalence of 57.61% (Table 1).

Among the diagnosed cases, those due to metabolic problems are the most recurrent throughout the year, followed by parasitic, bacterial, and finally trauma such as blows, bites, lacerations, etc., mainly due to poor facilities of the production units and the presence of

Table 1. Prevalence rate according to the type of disease

Disease	Number of cases	Prevalence rate %
Metabolic	39	21.20
Parasitism	27	14.67
Bacterial	24	13.04
Traumatism	13	7.07
Undetermined	3	1.63

feral dogs. Figure 1 showed an average of approximately 9 cases per month, with January and September being the months with the highest number of disease presence, followed by the months of May and July, stabilizing the cases from October and with a lower number of cases in January 2020.

In this study, the increase in diseases in the months of January and September can be associated with the fact that bacterial diseases are more recurrent during winter (January) and in the rainy seasons (May-October), since during these months the temperature changes , humidity and rangelands conditions, together with the winds, cause cold stress, affecting the immune system and with it the presence of opportunistic agents that cause damage to the animal's organism (Peter *et al.*, 2015).

On the other hand, metabolic diseases are frequent throughout the year, since they are the result of poor management in cattle herds (García & Vázquez, 2020), this is due to the fact that most of the time the livestock grazes in overgrazed and poorly managed rangelands, double-purpose or semi-stalled farms in Mexico, and especially in the southern region of Jalisco, are characterized by poor nutritional management, poor mineral supplementation and only attempts to improve nutrition through corn and sugar cane stubbles, concentrates and rarely with the use of corn silages, which leads to a low productive yields and low reproductive efficiency (Magaña-Monforte *et al.*, 2006). Therefore, malnutrition appeared in third place among the problems detected with a 5% CIR (cumulative incidence rate), only after gastrointestinal parasites and mastitis, with a CIR of 12 and 6%, respectively (Table 2).

Since most of the local livestock smallholders focus on milk production, mastitis is a common problem in this type of production units, the lack of an adequate milking routine by mostly of the owners since these units are managed under a cow-calf system and manually milking. In a study carried out by Castañeda-Vázquez *et al.* (2013) in 33 dairy herds from different regions of the state of Jalisco from 67 to 54.5% of the cows presented subclinical and clinical mastitis, respectively. The foregoing gives us an epidemiological vision that in the state the main pathogens that cause mastitis are *Staphylococcus aureus*, *S. agalactiae*,

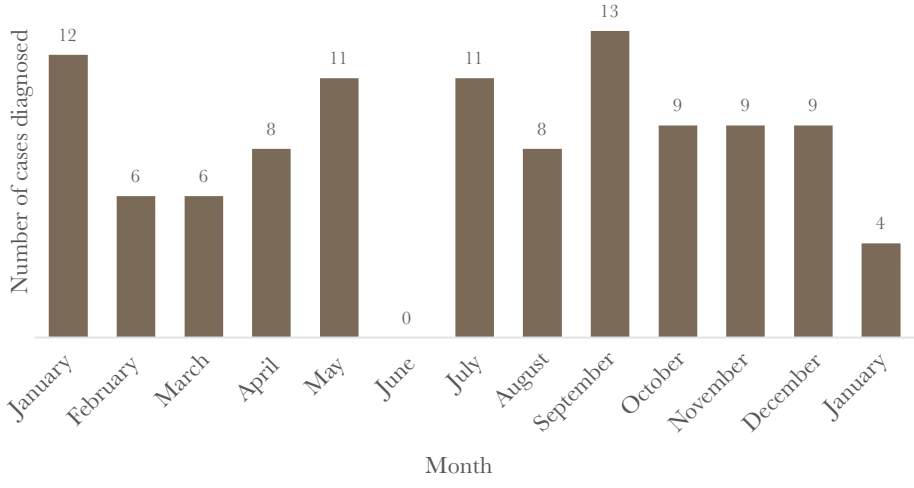

Figure 1. Number of cases diagnosed per month (2019-2020).

Table 2. Cumulative incidence rate (CIR) of detected diseases (n=184).

Disease	CIR %
Gastrointestinal parasites	12
Mastitis	6
Animal malnutrition	5
Tympanism	4
Rumen acidosis	4
Traumatism [a]	4
Retained placenta	3
Pyometra	3
Respiratory tract infection	2
Tick infestation	2
Mechanical diarrhea	2
Poisoning by toxic plants	2
Pododermatitis	2
Nipple laceration	2
Abortion	2
Anaplasmosis y piroplasmosis	1
Omphalophebitis	1
Actinomycosis	1
Ulcer in mammary gland	1

[a] Traumatism was considered those caused by a sharp object to the legs or hooves and dog bites.

Corynebacterium spp. and coliforms, in that order, so future studies in the southern region of Jalisco should consider the identification of pathogens, to contrast these findings at the state level, to adapt milking routines for the dairy cow producers in the region.

In the case of gastrointestinal parasites Fernández *et al.* (2015), observed that the highest number of parasites in cattle grazed in the months of May and June, probably because after the dry season, the parasites have not yet reached their full development.

Table 2 shows the CIR of the diseases presented during the year of the present study where it can be found that infestations by gastrointestinal parasites are those that showed a higher incidence in a year. Helminth infestations are one of the most important causes of diseases and low productivity in cattle in the world, being even more notorious in temperate and tropical climates since these conditions support the incidence and presence of gastrointestinal parasites in cattle, causing not only clinical parasite problems, but also effects in the subclinical phase that are not visible and that cause deficiencies in the use of nutrients, which increases losses in animal production (Vercruysse & Claerebout, 2001; Molento *et al.*, 2011), the above in according with the findings in this study, where gastrointestinal parasites (12%) represented the highest CIR and could be associated with some metabolic problems (21.20%) that occupy the highest prevalence rate in this studio (Table 1).

Rodríguez-Vivas *et al.* (2001), conducted a review of 3,827 bovine samples taken between 1984 and 1999, where they found that the most frequent gastrointestinal parasites were from the *Coccidia* family (71.57%) and *Strongylida* (60.64%), on the other hand, the most common genera were *Strongyloides* spp. (9.87), *Trichuris* spp. (8.28), and *Moniezia* spp. (3.86) these results differ from those found in this study, where gastrointestinal parasites of the genus *Moniezia* spp. (27.27%) were found with the highest prevalence, while the genus *Trichuris* spp. (4.55%) was the one with the lowest rate in this study (Table 3).

This contrasts with the results obtained in a study carried out by Munguía-Xóchihua *et al.* (2019), where the most abundant parasites of the nematode group were *Haemonchus* spp. (79.5%), *Oesophagostomum* spp. (40.4%) and *Trichostrongylus* spp (34.8%) in southern Sonora and with those reported (Fernández *et al.*, 2015), in Hidalgotitlan, Veracruz where they found that the *Cooperia* spp. nematode occupied 49% of the total infestation; followed by *Ostertagia* spp. (15%), *Haemonchus* spp. (15%), *Trychostrongylus* spp. (7%), *Moniezia* spp. (5%), *Toxocora vitolorum* 4%, *Trichruris ovis* (4%) and *Chavertia ovina* (1%). This may be due to the agroecological conditions of the places where these studies were carried out. In the case of monieziosis, occurs in grazing cattle, this is common in the semi-stalled systems of Gomez Farias, where infected cattle contaminate the grazing areas with eggs of this cestode and where the intermediate hosts (oribatid mites) help to maintain the life cycle of the parasite (Quiroz, 2011). The domestic animals and particularly cattle are parasitized by a large variety of nematodes, cestodes and protozoa, which makes it necessary to carry out more local studies of this type to identify and quantify the economic impact of parasitic infections in cattle in the southern region of Jalisco, Mexico, and with this to be able to establish control programs parasite control adapted to each region of the country.

The high incidence of parasites in this study not only represents a health problem for cattle, but also an economic one for producers, since in countries with more rigorous management practices and health programs such as the United States, it has been calculated that the average losses costs for parasites for the livestock industry was US $50.67 animal/year, which represents 17.94% of the total losses within a herd (Rashid *et al.*, 2019). In Brazil, it was estimated that at least US$13.96 million were lost annually due to the presence of internal and external parasites in cattle (Grisi *et al.*, 2014). While, in Mexico considering the national bovine inventory registered in 2013 that had 32.40 million heads,

Table 3. Prevalence rate of gastrointestinal parasites*

Genera	Prevalence rate (%)
Moniezia spp.	27.27
Haemonchus spp.	18.18
Ostertagia spp.	13.64
Cooperia spp.	9.10
Chabertia spp.	9.10
Eimeria spp.	9.10
Trichostrongylus spp.	9.10
Trichuris spp.	4.55

*Determination by flotation method.

gastrointestinal parasites represented an annual loss per head of US $43.57 (Rodríguez-Vivas *et al*., 2017). For the regional and even national environment, the number of studies related to monitoring the economic impact of gastrointestinal parasites is very limited. In the present work, a monitoring investigation was carried out in order to detect the incidence of productive diseases in semi-stalled dairy cows. The general panorama obtained in the present study demonstrates the magnitude and importance of the challenges faced by milk producers that are managed under semi-stall systems in Mexico, so future studies that take into account the economic impact are necessary to generate useful information to maximize the profitability of the livestock industry together with the integration of sustainable and comprehensive management strategies (Cerdas, 2013; Olivares-Pérez *et al*., 2015; Rodríguez-Vivas *et al*., 2017).

CONCLUSION

In this study, it was identified that the most frequently problems are metabolic, followed by gastrointestinal parasites, especially *Moniezia* spp. In addition, the herds in this study located in San Andrés Ixtlán, Gómez Farías county, Jalisco, Mexico, showed a moderate to low probability of presenting bacterial diseases such as mastitis and actinomycosis, respectively.

It is concluded that the owners of dairy cows in semi-stalled systems in the town of San Andres Ixtlan face problems of productive impact generally associated with deficient health and nutritional management programs, for which it's recommended to implement prevention and control of these diseases, as well as adequate nutritional supplementation according to the productive stage of cattle to reduce economic losses in animal production, likewise the need for regional studies to determine the problems faced by small dairy farmers in the different regions of the state of Jalisco.

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