



# The Prevalence of *Giardia duodenalis* in Dairy Calves and Cattle in Firozabad City, Iran

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## Abstract

**Background aim:** *Giardia duodenalis* is a waterborne and foodborne zoonotic protozoan, which infects the gastrointestinal tract of humans and animals, causing infection in cattle with enteric manifestations accompanied by diarrhea. Giardiasis causes immense economic losses, especially in meat- and milk-oriented cattle farms, attributed to high treatment costs, calf mortality, and decreased weight gain in animals. The present study focuses on determining the prevalence of bovine *G. duodenalis* infection in cattle in Firozabad city, taking into account the favorable conditions of husbandries of this city in Fars Province, Iran.

**Material and Methods:** A total of 451 fresh fecal samples were randomly collected from six dairy farms in Firozabad city, and categorized based on age and type of farm. The samples were subjected to macroscopic observation and the fecal flotation method. The obtained results were statistically analyzed using SPSS software and the Chi-square test (X<sup>2</sup>).

**Results:** Sixty-two samples were positive and the overall prevalence for *G. duodenalis* was 13.7%. In terms of age, the number of infected preweaned calves, postweaned calves, young cattle and adult cattle was (15.2%), (16%), (10.1%) and (14.6%) respectively. In terms of the type of keeping, 4 samples (3.5%) were positive in semi-industrial farms and 28 samples (8.3%) were positive in traditional farms.

**Conclusion:** The statistical analysis shows there was a significant association of *G. duodenalis* infection with the age of animals (calves show more infection than cattle) ( $p < 0.05$ ) and a significant relationship between the breeding type and the percentage of disease was observed (traditional farms have more positive samples than semi-industrial farms) ( $p < 0.05$ ).

**Keywords:** *Giardia duodenalis*, Cattle, Firozabad city, Iran

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## Introduction

*Giardia duodenalis* (Styles, 1902), also known as *G. lamblia* or *G. intestinalis*, is a zoonotic protozoan pathogen with the capacity to infect both humans and animals via ingestion of contaminated water and food sources (Mateusa et al., 2023; Dixon et al., 2021). In cattle, *Giardia* infection can precipitate gastrointestinal disturbances, particularly in calves under six months of age, manifesting as diarrhea, maldigestion, and malabsorption, ultimately leading to compromised growth and weight loss (O'Handley et al., 2001). While clinical giardiasis tends to be more severe in younger bovines, adult cattle, particularly during the periparturient period, can shed cysts asymptomatically (Mateusa et al., 2023; Geurden et al., 2012; Olson et al., 2004).

Transmission of giardiasis within livestock populations can occur through various modalities, including direct calf-to-calf contact or fecal-oral contamination of shared implements or mammary glands (Geurden et al., 2010). Genetic analyses have delineated at least eight distinct lineages of *G. duodenalis*, denoted assemblages A–H (Ryan et al., 2019; Xiao et al., 2017; Qi et al., 2016), with zoonotic assemblages A and B predominating in calves and posing an elevated risk of interspecies transmission to humans (Qi et al., 2016; Geurden et al., 2008; Dixon et al., 2011; Geurden et al., 2008; Ng et al., 2011).

Recently, feline-specific assemblage F was found in asymptomatic adult cattle in northern Spain (Cardona et al., 2015). The economic repercussions of giardiasis on cattle enterprises are noteworthy, encompassing expenses associated with treatment, calf mortality, and diminished weight gain in afflicted animals (Rocha Valdez et al., 2019). Global epidemiological investigations employing molecular methodologies have unveiled heterogeneous prevalence rates of bovine *G. duodenalis* infection, with Canada reporting the highest incidence (55.4% in Canada) and Iran registering the lowest (4.2% in Iran). Research endeavors have been undertaken in diverse geographical locales, including Iran, to elucidate the prevalence, genetic diversity, clinical presentations, and abundance of *G. duodenalis* in cattle cohorts (Ghadrdan Mashhadi et al., 2010; Kiani-Salmi et al., 2019; Malekifard et al., 2018; Taghipour et al., 2022). This investigation seeks to ascertain the prevalence of bovine *G. duodenalis*

infection in cattle populations from Firozabad city in Fars Province, Iran. Given the propitious husbandry conditions prevailing in this region and the paramount importance of prophylactic measures over therapeutic interventions, a comprehensive understanding of the prevalence of *Giardia* infection in cattle can inform the development and implementation of efficacious control strategies.

## Materials and Methods

A descriptive, analytical, and cross-sectional study was conducted in Firozabad city from March to August 2023 to investigate the prevalence of *Giardia duodenalis* in cattle populations. A total of 451 fresh fecal samples were randomly collected from six dairy farms in the city. The samples comprised 72 preweaned calves (0–60 days), 87 postweaned calves (61–180 days), 128 young cattle (181–360 days), and 164 adult cattle (>361 days). Among the sampled animals, 335 samples were from calves and cattle were kept in traditional farms, while 116 samples were belonging to semi-industrial farms. Information regarding the presence of diseases such as diarrhea was recorded during sampling. Prior to data collection, no information was available regarding the epidemiological situation of the farms. Macroscopic examination was initially conducted to determine the consistency of fecal samples, with observations categorized as shaped, semi-shaped, soft, or watery, serving as an indicator of potential parasite presence. Trophozoites, the motile forms of enteric protozoa, are typically found in soft or watery specimens, while cyst forms are commonly observed in morphotypes and hemimorphotypes. The eggs of parasitic worms may be present in any sample. Subsequently, the fecal flotation method was employed, involving the removal of half a teaspoon of fecal sample (2.84 grams) placed in a waxed paper cup. 30 ml of flotation solution sodium nitrate (Baharafshar Co, LTE, Iran) was added, and the mixture was stirred to ensure homogeneity. The liquid was then strained through a sterile gauze into a glass tube, which was then filled completely and covered with a coverslip. Following a waiting period of 10 to 20 minutes, the slide was examined under a microscope (Nikon E100, Japan) after staining with a trichrome kit (Farzaneh Araman Co. LTE, Iran). Statistical analysis was performed using the Chi-square test to compare *G. duodenalis* infection rates among different age and

sex groups, as well as traditional and industrial farm settings. A 95% confidence interval was calculated using SPSS Statistics 21.0 (IBM Corp., New York, NY, USA), with a p-value below 0.05 considered statistically significant. This rigorous methodology ensured the accurate assessment of *Giardia* prevalence in the cattle population of Firozabad city.

## Results

The present study revealed a *G. duodenalis* prevalence of 13.7%, with 62 out of 451 fecal samples testing positive for the parasite. Age-stratified analysis indicated varying infection rates across different age groups, with 15.2% of preweaned calves, 16% of postweaned calves, 10.1% of young cattle, and 14.6% of adult cattle showing infection. Statistical analysis demonstrated a significant association ( $p < 0.05$ ) between *G. duodenalis* infection and the age of the animals, highlighting higher

prevalence in postweaned calves compared to preweaned calves (Figure 1). Furthermore, the investigation into the type of husbandry practices revealed distinct infection rates based on farm management. Among the 116 animals housed in semi-industrial farms, 3.5% tested positive for *G. duodenalis*, while 8.3% of the 335 animals in traditional farms showed infection (Figure 2).

The statistical analysis underscored a significant relationship ( $p < 0.05$ ) between the type of maintenance and disease prevalence, with a higher prevalence observed in animals from traditional farms compared to those in semi-industrial settings. These findings emphasize the importance of considering both age and husbandry practices in assessing *G. duodenalis* prevalence in cattle populations, providing valuable insights for effective control and management strategies in livestock farming environments.

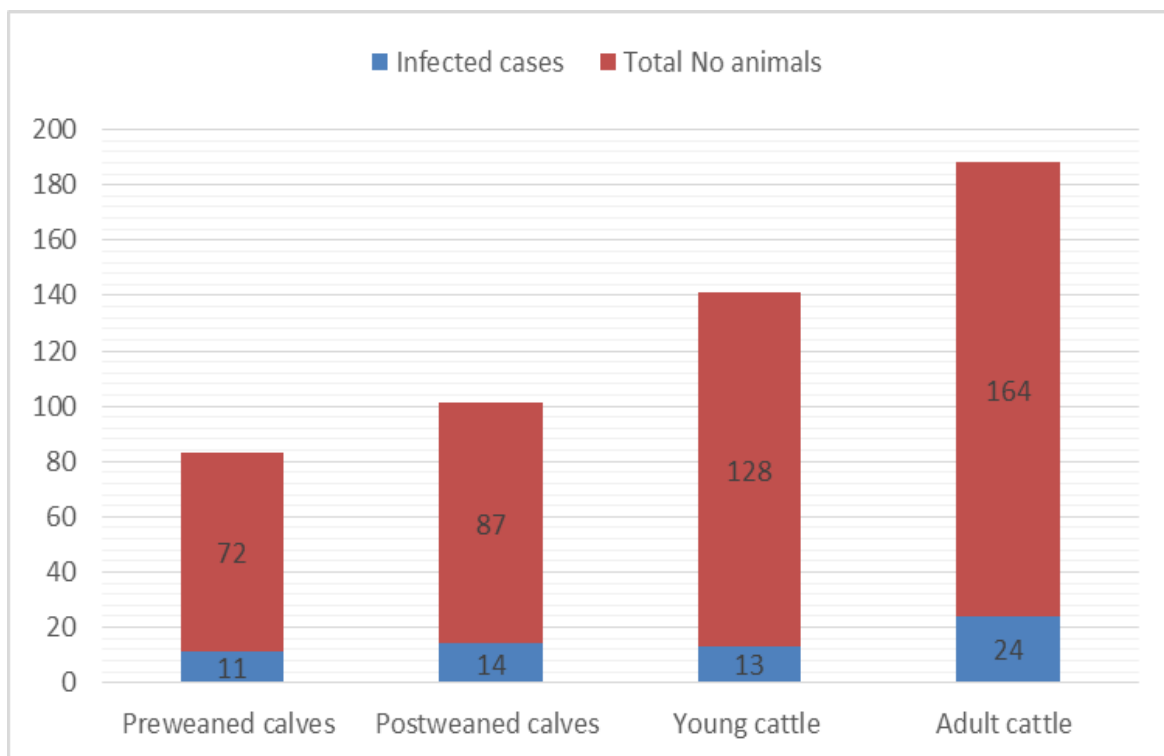
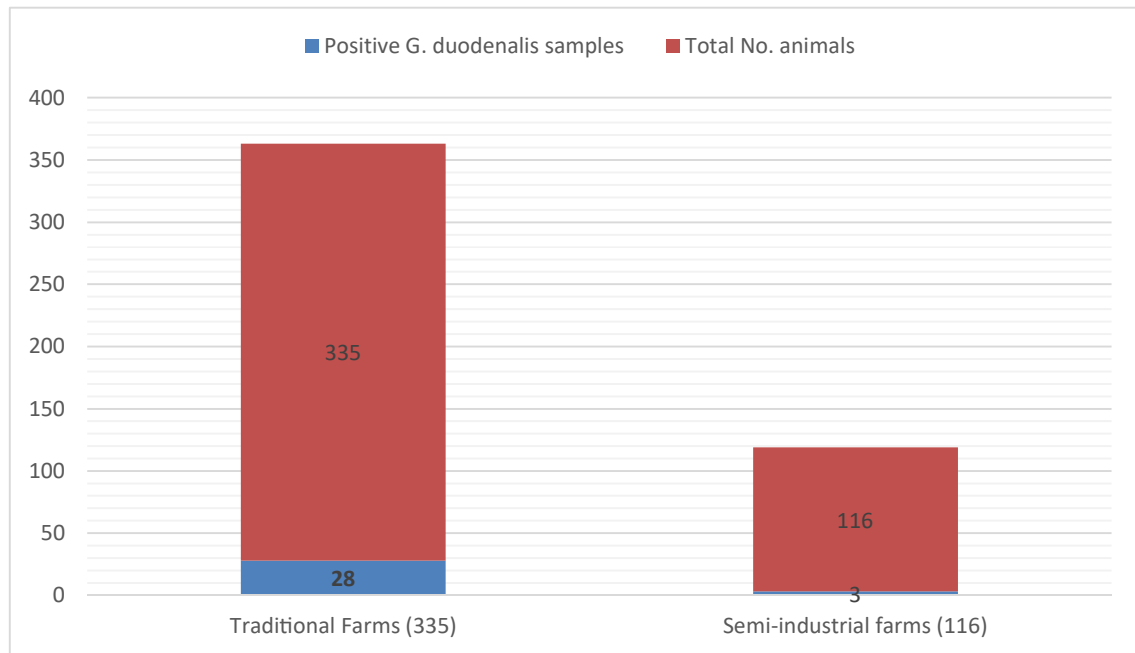


Figure 1. The prevalence for *G. duodenalis* by age.



**Figure 2.** The prevalence for *G. duodenalis* by type of keeping.

## Discussion

The prevalence of *Giardia duodenalis* in cattle populations is a subject of significant interest and concern, particularly in regions like Iran where livestock farming plays a crucial role in the economy.

Various studies have been conducted to investigate the level of *Giardia* infection in different parts of the country, shedding light on the factors influencing its prevalence. In a study conducted in Tehran, it was found that the level of *Giardia* infection in calves was consistent with global figures, highlighting the ubiquitous nature of this protozoan pathogen (Ghadrdan Mashhadi *et al.*, 2010).

Similarly, research in Urmia and Yazd provinces revealed varying prevalence rates, with higher rates observed in some regions compared to others, in Urmia, northwest of Iran, totally, 23 (9.34%) fecal samples were microscopically positive for giardia cyst out of 246 examined samples (Malekifard *et al.*, 2018). In the survey conducted in Yazd Province, central Iran, 25 (5.16%) of examined faecal samples were infected with *G. duodenalis*. This study shows the prevalence of infection with *Giardia* in this hot-arid area of Iran was low (Kiani-Salmi *et al.*, 2019). The study conducted in Fars Province, Iran, by Asghari *et al.* in 2022, reported a prevalence of 10.7% for *Giardia* infection based on microscopic examination, indicating the presence of human

transmission routes in the region (Asghari *et al.*, 2022). In the current investigation in Firozabad city, a prevalence of 13.7% was observed, further emphasizing the need for comprehensive surveillance and control measures to mitigate the impact of giardiasis on cattle populations.

Age has been identified as a significant factor influencing the prevalence of *Giardia* infection, with younger animals being more susceptible to the disease. Studies have shown that mature cows exhibit a lower prevalence of *Giardia* compared to calves, suggesting a potential role of the immune system in protecting against infection. Due to some restricted conditions for taking sample from calves and cows on semi- industrial husbandries, our samples mostly was taken at traditional husbandries; However, the type of cattle keeping practices, such as industrial versus traditional farms, can also impact the prevalence of *Giardia*, with better hygiene practices and health monitoring contributing to lower contamination rates.

Preventive measures such as testing and culling infected animals, improving environmental conditions for livestock, implementing quarantine protocols, and providing veterinary care are essential for controlling the spread of *Giardia* in cattle populations. By understanding the factors influencing the prevalence of *Giardia* in different regions and implementing targeted control strategies, we can work towards

safeguarding animal health and minimizing the risk of transmission to humans. Continued research into the prevalence and incidence of *Giardia* across various regions is imperative to inform effective disease management practices and protect both animal and human populations.

### Conclusion

The overall prevalence for *G. duodenalis* was 13.3%. The statistical analysis shows there was a significant association of *G. duodenalis* infection with the age of animals (calves shows more Infection than cattle) and a significant relationship between the type of maintenance and the percentage of disease was observed (traditional farms have more positive samples than semi-industrial farms).

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### Conflict of interest

The authors declare no conflict of interest.

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## بررسی شیوع ژیاوردیا دئودنالیس در گوساله ها و گاوهای شیری شهرستان فیروزآباد، ایران

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### چکیده

**زمینه و هدف:** ژیاوردیا دئودنالیس یک تک یاخته مشترک بین انسان و دام منتقله از طریق آب و غذا است که دستگاه گوارش انسان و حیوانات را آلوده می کند و باعث ایجاد عفونت در گاو با تظاهرات روده ای همراه با اسهال می شود. ژیاوردیازیس باعث خسارات اقتصادی بسیار زیادی می شود، به ویژه در گاوداری های گوشتی و شیری که به هزینه های بالای درمان، مرگ و میر گوساله ها و کاهش افزایش وزن در حیوانات نسبت داده می شود. مطالعه حاضر با توجه به شرایط مساعد دامداری این شهرستان در استان فارس، بر تعیین شیوع عفونت ژیاوردیا دئودنالیس گاوی در گاوهای شهرستان فیروزآباد متمرکز است.

**مواد و روش ها:** در مجموع ۴۵۱ نمونه مدفوع تازه از شش گاوداری شهرستان فیروزآباد به طور تصادفی جمع آوری و بر اساس سن و نوع مزرعه طبقه بندی شدند. نمونه ها تحت مشاهده ماکروسکوپی و روش فلوتاسیون مدفوع قرار گرفتند. نتایج به دست آمده با استفاده از نرم افزار SPSS و آزمون مربع کای (X<sup>2</sup>) مورد تجزیه و تحلیل آماری قرار گرفت.

**یافته ها:** شصت و دو نمونه مثبت و شیوع کلی ژیاوردیا ۱۳/۷ درصد بود. از نظر سنی، تعداد گوساله های شیری آلوده، گوساله های از شیر گرفته نشده، گاوهای جوان و گاو بالغ به ترتیب (۱۵/۲٪)، (۱۶٪)، (۱۰/۱٪) و (۱۴/۶٪) بود. از نظر نوع نگهداری، ۴ نمونه (۳/۵ درصد) در مزارع نیمه صنعتی و ۲۸ نمونه (۸/۳ درصد) در مزارع سنتی مثبت بودند.

**نتیجه گیری:** تجزیه و تحلیل آماری نشان می دهد که ارتباط معنی داری بین عفونت ژیاوردیا دئودنالیس با سن حیوانات وجود دارد (گوساله ها نسبت به گاو آلودگی بیشتری نشان می دهند) و ارتباط معنی داری بین نوع نگهداری و درصد بیماری (مزارع سنتی نمونه های مثبت بیشتری دارند. نسبت به مزارع نیمه صنعتی) مشاهده شد.

**واژه های کلیدی:** ژیاوردیا دئودنالیس، گاو، شهرستان فیروزآباد، ایران

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