

Prevalence of *Cryptosporidium* spp. and *Giardia* spp. in Cows and Calves in Sivas

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Abstract: The prevalence of *Cryptosporidium* spp. and *Giardia* spp. in healthy asymptomatic cows and calves was investigated on 30 farms in Şarkışla in Sivas. The population on these farms consisted of 457 animals: 47 calves 15-45 days old, 48 calves 45-90 days old, 38 calves 90 days-6 months old, 254 calves 6 months-1 year old, 60 cattle 1-3 years old, and 10 cattle 9-15 years old.

Cryptosporidium spp. oocysts were identified by zinc sulphate flotation technique and modified acid fast stain methods in cattle ranging from 15 days old to adults. *Cryptosporidium* spp. positive animals were found at all (100%) farms. The overall prevalence of *Cryptosporidium* spp. was 70.3% and 31.4% in cows and calves, respectively. The prevalence of *Cryptosporidium* spp. was significantly ($\chi^2= 39.00$; $P < 0.05$) lower in calves than in adults.

Giardia spp. cysts were identified in 17 animals (3.7%) from 11 (36.6%) of the farms surveyed by direct examination and zinc sulphate flotation technique. Prevalence rates of *Giardia* spp. in cows and calves were 1.4% and 4.1%, respectively. *Giardia* spp. cyst shedding was found in the faecal samples of all animal groups except for those 1-9 years old. Between calves and adults, the prevalence of *Giardia* spp. was not significantly different ($\chi^2= 1.21$; $P > 0.05$).

These findings clearly demonstrate that asymptomatic infections in calves and cows infected with *Giardia* spp. and *Cryptosporidium* spp. play a potential role as reservoirs for humans.

Key Words: *Giardia*, *Cryptosporidium*, cattle, calves, prevalence

Sivas'ta Sığır ve Buzağlarda *Cryptosporidium* spp. ve *Giardia* spp.'nin Yaygınlığı

Özet: Bu çalışmada, Sivas'ın Şarkışla ilçesindeki 30 farklı çiftlikte asemptomatik sığır ve buzağlarda *Cryptosporidium* spp. ve *Giardia* spp. yaygınlığı araştırıldı. Bu çiftliklerdeki 457 hayvanlık populasyon: 15-45 günlük 47 buzağı, 45-90 günlük 48 buzağı, 90 gün-6 aylık 38 dana, 6 ay- 1 yaş arası 254 dana, 1-9 yaş arası 60 sığır ve 9-15 yaş arası 10 sığırdan oluşmakta idi.

Alınan dışkılar, çinko sülfat yüzdürme ve modifiye asit fast boyama yöntemi ile *Cryptosporidium* oocistleri açısından incelendi. 15 günlük buzağlardan erişkinlere kadar olan tüm gruplarda oocistler saptandı. Çiftliklerin tamamında (% 100) *Cryptosporidium* spp. pozitif hayvanlar bulundu. Sığırlarda *Cryptosporidium* spp. yaygınlığı % 31,4 buzağlarda ise % 70,3 olarak belirlendi. Sığır ve buzağlarda *Cryptosporidium* spp. görülme oranı arasındaki fark istatistiksel olarak anlamlı ($\chi^2= 39,00$; $P < 0,05$) bulundu.

Çiftliklerin 11'indeki (% 36,6) 17 hayvanda, direkt inceleme ve çinko sülfat yüzdürme yöntemi kullanılarak *Giardia* spp. kistleri saptandı. Sığırlarda *Giardia* spp.'nin yaygınlığı % 1,4 buzağlarda ise % 4,1 olarak bulundu. Bir-9 yaş arası sığırlar dışında kalan tüm yaş gruplarında *Giardia* kistlerine rastlandı. Sığır ve buzağlarda *Giardia* spp. görülme oranı arasındaki fark istatistiksel olarak önemsiz ($\chi^2= 1,21$; $P > 0,05$) bulundu.

Bu bulgular, *Cryptosporidium* spp. ve *Giardia* spp. ile infekte olmasına rağmen pek klinik bozukluk göstermeyen hayvanların, insanlar için potansiyel rezervuar rolü oynayabileceğini göstermektedir.

Anahtar Sözcükler: *Giardia*, *Cryptosporidium*, sığır, buzağı, yaygınlık

Introduction

Cryptosporidium parvum and *Giardia intestinalis* are intestinal parasites commonly identified in mammals. *C. parvum* and *G. intestinalis* infections also occur in

humans. Of *C. parvum*, some genotypes can be transmitted from animals to humans. Both *C. parvum* and *G. intestinalis* are found ubiquitously in surface waters (1). It has been suggested that outbreaks of

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cryptosporidiosis and giardiasis in humans may be attributed to contamination of drinking water by dairy pasture run-off. *Giardia intestinalis* has been associated with reduced milk production (2), it appears to occur in animals of all ages (in contrast to *C. parvum*, which occurs more frequently in young calves), and is not considered a public health threat (3,4).

Although Cryptosporidium and Giardia infections have been reported for cattle in many parts of the world, prevalence data have often varied markedly. The high prevalence of Cryptosporidium and Giardia in neonates and young calves is well known (5). Detection procedures for acquiring, cleaning, concentrating, and identifying parasites differ significantly from laboratory to laboratory. Some techniques are markedly more sensitive and accurate than others in detecting and identifying parasites, thereby influencing the data upon which the prevalence of infection is based (6).

C. parvum, first reported as an enteropathogen in a calf in 1971, is now reported as prevalent and widespread in calves from 4 days to 4 weeks of age by numerous investigators in many countries. Subsequent studies in Spain (7) and Scotland (8) have also reported *C. parvum* in post-weaned and adult cattle. In contrast, no studies have focused on post-weaned or cows in Turkey and the studies performed have reported few infections with Cryptosporidium in calves (9,10). Furthermore, no detailed reports on the investigation of the prevalence of giardiasis in cows and calves have been published (11).

In the light of the reported clinical disease, production losses and (with regard to Cryptosporidium and *G. intestinalis*) public health impact, the major objective of the present study was to determine the recent prevalences of Cryptosporidium spp. and Giardia spp. in calves and cows at 30 dairy farm in Sivas, Turkey.

Materials and Methods

The research was conducted on 30 dairy farms in Şarkışla in Sivas. The dairy population on the farm consisted of 457 animals: 47 calves 15-45 days old, 48 calves 45-90 days old, 38 calves 90 days-6 months old, 254 calves 6 months-1 year old, 60 cattle 1-3 years old, and 10 cattle 9-15 years old (Table 1).

Between March and May 2002, fresh faecal samples (n = 457) were collected from cows and calves at 30 farms in Sivas, Turkey. A small number of samples was collected from the ground where the cows had recently defaecated. Faecal samples were collected from each calf’s rectum using a disposable latex glove. One collection was performed for each animal. Samples were placed in glass containers and stored at 4 °C until Cryptosporidium oocysts and Giardia cysts could be enumerated.

Faecal samples (n: 457) were examined by direct examination (native-lugol), zinc sulphate flotation technique, and modified acid fast stain methods for Cryptosporidium. The same samples were examined by direct examination (native-lugol) and zinc sulphate flotation technique for Giardia.

Table 1. The prevalence rates of Giardia spp. and Cryptosporidium spp. in different age groups.

Age	Giardia spp.		Cryptosporidium spp.	
	Number of infected animals/ total animals	(%)	Number of infected animals/ total animals	(%)
15-45 days	5/47	(10.6)	29/47	(61.7)
45-90 days	7/48	(14.6)	34/48	(70.8)
90 days-6months	2/38	(5.3)	20/38	(52.6)
6 months-1 year	2/254	(0.8)	189/254	(74.4)
1-9 years	0/60	(0.0)	21/60	(35)
9-15 years	1/10	(10)	1/10	(10)
Total	17/457	(3.7)	294/457	(64.3)

Influence of age on the prevalence of *Cryptosporidium* spp. and *Giardia* spp. was analysed using Fisher's exact test and chi-square test. Probability values of $P < 0.05$ were considered significant.

Results

Faecal samples from 457 animals randomly selected at 30 farms in Şarkışla in Sivas were examined to investigate the prevalence of *Cryptosporidium* and *Giardia* infections.

Prevalence rates of *Giardia* spp. in cows and calves were 1.4% and 4.1%, respectively (Table 2). *Giardia* spp. cysts were found in all age categories except for those 1 years-9 years old, but prevalence was highest in animals 45-90 days old with 7 of 48 animals (14%) shedding cysts. Among the 47 samples taken from calves younger than 45 days old 5 were positive for *Giardia* spp. cysts. The parasite was found in 1 of the 60 animals 9-15 years old (Table 1). Between calves and cows, the prevalence of *Giardia* spp. did not differ significantly ($\chi^2 = 1.21$; $P > 0.05$).

The oocysts of *Cryptosporidium* spp. were found in all age categories, but were rare in cows 1-9 years old. The highest prevalence was found in animals 6 months-1 years old. The overall prevalence of *Cryptosporidium* spp. was 70.3% and 31.4% in cows and calves, respectively (Table 2). The prevalence of *Cryptosporidium* spp. was significantly ($\chi^2 = 39.00$; $P < 0.05$) lower in calves than in adults.

Discussion

Giardiasis and cryptosporidiosis are parasitic infections of humans, domestic animals, and wildlife. Cattle are frequently parasitised with *Giardia duodenalis*, *Cryptosporidium parvum* and *Cryptosporidium andersoni*. These parasites cause diarrhoea and impair gain of body weight. *Giardia* and *Cryptosporidium* from cattle are potential zoonotic pathogens, and contact with animals, manure or contaminated water is thought to lead to infections in humans. As reports of the common occurrence of *Giardia* and *Cryptosporidium* in cattle have increased, so has concern as to the role of cattle as the source of waterborne outbreaks of giardiasis and cryptosporidiosis (12). In Turkey, there are few studies in the literature on the prevalence of cryptosporidiosis (9,10). Furthermore, no detailed reports on investigations of the prevalence of giardiasis in cattle and calves have been published (11).

Given that *Giardia* has the potential to cause clinical disease in cattle and to be transmitted to other animal species and humans, detection of the parasite in cattle may be of major epidemiological significance (13).

While isolated studies have reported giardiasis in cattle and sheep in Africa, Europe and North America, an extensive study of the prevalence of the disease in domestic ruminants has never been reported (13).

In our study, which was undertaken to investigate the prevalence of these parasites in cattle at different 30 farms in Sivas, Turkey, prevalence rates of *Giardia* spp. in cows and calves were 1.4% and 4.1%, respectively. *Giardia* spp. cysts were found in all age categories except

Table 2. Prevalence rates of *Giardia* spp. and *Cryptosporidium* spp. in cows and calves.

	<i>Giardia</i> spp.*		<i>Cryptosporidium</i> spp.**	
	Number of infected animals/ total animals	(%)	Number of infected animals/ total animals	(%)
Calves	16/387	(4.1)	272/387	(70.3)
Cows	1/70	(1.4)	22 /70	(31.4)
Total	17/457	(3.7)	294 /457	(64.3)

* $\chi^2 = 1.21$; $P > 0.05$

** $\chi^2 = 39.00$; $P < 0.05$

for those 1 years-9 years old, but prevalence was highest in animals 45-90 days old, with 7 of 48 animals (14%) shedding cysts. Between cows and calves, the prevalence of *Giardia* spp. did not differ significantly ($\chi^2 = 1.21$; $P > 0.05$).

While *Cryptosporidium* spp. oocysts were identified in all (100%) farms, *Giardia* spp. cysts were identified in 17 (3.7%) of the 457 animals from 11 (36.6%) of the 30 farms surveyed by direct examination and zinc sulphate flotation technique.

Despite the high prevalence of *Giardia* spp. in dairy cattle <6 months of age, the factors that predispose dairy animals to become infected with *Giardia* spp. are not fully known. The prevalence of *G. intestinalis* infections was determined in Western Canadian and Western Australian dairy calves by O'Handley et al. (14). Fifty eight percent of Western Australian calves and 57% of Western Canadian calves were positive for *Giardia*.

In various districts of Switzerland, 815 calves were selected randomly for a single coprological examination for giardiasis by Taminelli and Eckert (15). On average 26.6% of the calves excreted *Giardia* cysts. They postulated that *Giardia* infections were frequent and geographically widely distributed in calves and lambs in Switzerland.

In Canada, few studies have been published on the prevalence of giardiasis. In the first study, calves were sampled from 505 dairy farms (16). It was reported that 45.7% of the farms were positive for *Giardia* spp. and 88.7% were infected with *Cryptosporidium* spp. In another study in Canada, faecal samples were collected from beef calves aged 2–10 weeks at 9 farms in Alberta. Samples were examined for the presence of *G. duodenalis* cysts by immunofluorescent staining. *Giardia* cysts were found in 168 of the 495 faecal samples examined, with prevalence ranging from 7% to 60% among the farms (17).

In the USA, to determine the prevalence of *Giardia* genotypes in pre-weaned dairy calves, faecal samples were collected from a minimum of eighteen, 1–7-week-old dairy calves per farm on 2 farms each in the states of

Vermont, New York, Pennsylvania, Maryland, Virginia, North Carolina, and Florida. Prevalence ranged from 9% on a farm in Pennsylvania to 93% on a farm in Vermont, with an average prevalence for 407 calves on 14 farms of 40% (18).

We found that in cows the overall prevalence of *Cryptosporidium* spp. was 31.4%, with 70.3% of calves infected with this parasite. The oocysts of *Cryptosporidium* spp. were found in all age categories, but were rare in cows 1-9 years old. The highest prevalence was found in animals 6 months-1 years old. The prevalence of *Cryptosporidium* spp. was significantly ($\chi^2 = 39.00$; $P < 0.05$) lower in calves than in cows.

Xiao and Herd (13) collected faecal samples weekly over a 3-month period from calves 0-20 weeks old on an Ohio dairy farm, and examined them for *Cryptosporidium* oocysts and *Giardia* cysts. Oocysts and cysts were detected as early as 4 days of age. We detected *Cryptosporidium* spp. as early as 10 days of age and *Giardia* spp. as early as 22 days of age.

Knowledge of age and seasonal variations in the prevalence of shedding of *Cryptosporidium* oocysts and *Giardia* cysts by dairy cattle may be helpful in designing prevention plans to minimise economic losses due to these parasites and potential hazards to public health. Wade et al. (19) suggested that *C. parvum* mainly infects young calves and that the *Cryptosporidium* species found in animals older than 30 days is most likely *C. andersoni*. The identification of *C. andersoni* as a new species infecting cattle clearly shows the need for detailed studies on the occurrence of the 2 species in cattle of different ages and whether *C. parvum* infections are restricted to young calves.

It is concluded that transmission of infection with *Cryptosporidium* and *Giardia* occurs readily and is difficult to prevent. Important sources of infection appear to be adult cows, mechanical vectors and calves themselves. *Giardia* spp. and *Cryptosporidium* spp. are highly prevalent in dairy calves and impact adversely on animal health and production.

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