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Gastrointestinal Helminthic and Protozoal Infections of Goats in Satun, Thailand

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Abstract

Helminthic infections remain a major constraint to small ruminant production in Thailand, resulting in productivity losses through reduced feed intake and decreased efficiency in feed utilization. The objectives of this study were (i) to assess the prevalence of gastrointestinal (GI) parasitism in meat and dairy goats of Satun Province, Thailand; (ii) to determine the species of existing GI parasites; and (iii) to compare the parasite population of goats in different districts of Satun Province. The study was conducted in seven districts of Satun, in southern Thailand. A total of 1,026 fecal samples were collected and subjected to ethyl acetate centrifugation to identify parasite eggs or cysts. The overall helminthic prevalence among the goats was 76.4%. The results suggested that parasite prevalence was higher among meat (94.3%) than dairy (47.7%) goats, and among goats < 1 year of age (94.9%) than goats 1-2 years or > 2 years of age. La Ngu District had the highest prevalence (86.4%) of infections among the seven districts of Satun Province. No significant difference in GI parasite prevalence was associated with host sex. Most goats had multiple infections (79.7%). The high prevalence of parasitism among the goats possibly reflected grazing, and the lack of anthelminthic treatment programs.

Keywords: gastrointestinal helminths and protozoa, meat and dairy goats, Satun Province, Thailand

Introduction

The production of goats for meat or milk is an attractive agricultural enterprise for Thai farmers because of the relatively low cost of breeding stock, their high reproductive rate, and their ability to thrive on native pasture or brushland that is unsuitable for crops [1,2]. In addition, the local demand for goat meat and milk products is increasing in Thailand, particularly in the South, where most residents are Thai-Islamic. Moreover, goat's milk is considered a healthy food for human consumption. Despite these advantages, the growth of the goat industry has been sluggish.

Livestock productivity can be constrained by gastrointestinal (GI) parasitic infections, the consequences of which range from morbidity to mortality, especially for young animals, due to

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parasitic gastroenteritis [3-5]. Mortality rates in herds may exceed 40% while weight losses of 6-12 kg per animal per year can occur [6]. GI parasite burdens are frequently associated with grazing management. Therefore, animals that graze along the road or public places, such as farmers' markets and parks, are often at greater risk of exposure.

The distribution of goats in southern Thailand is mainly condensed within four border provinces. About 200,000 goats in Thailand and 17,000 goats in Satun Province were recorded for 2005 [7]. Most goats in Satun are raised for meat, and are usually maintained outdoors due to traditional and economic factors; therefore, these goats are more likely to be exposed to GI parasites [8].

Helminthic and protozoal infections have been reported among goats in Thailand [9-12]. It has also been found that GI parasitism among ruminants occurred all year in tropical climates such as Thailand, with higher infection intensities during the rainy season [13,14]. Temperature and humidity are primary factors involved in the development and survival of parasite eggs, larvae, cysts, and oocysts in the environment.

To date, the importance of caprine GI parasitic infections has not been investigated in detail in Satun Province. A comprehensive understanding of parasite epizootiology is crucial for the sustainable control of parasites that interact with hosts in a specific climate, management system and production environment. The specific objectives of this investigation were to assess the extent of GI parasitism of indigenous dairy and meat breeds of goats reared under traditional production systems, and to identify parasite species associated with geographical distribution, host sex and host age in Satun Province, Thailand.

Materials and methods

Study area

A total of 1,026 samples were collected from 202 small farms in seven districts of Satun Province (Table 1): Khuan Don (2 farms), Khuan Kalong (25 farms), La Ngu (80 farms), Ma Nang (5 farms), Muang (25 farms), Tha Phae (25 farms), and Thung Wa (40 farms).

Selection of flocks

Based on an estimated prevalence of 50% (with 95% confidence interval (CI)) and 5% desired precision, at least 50 goats were sampled from each district. Most meat goats were reared in small herds of 5-10 animals, while dairy goat farms ranged between 10-30 animals per farm (Table 1).

Table 1 Smallholder farms and goat populations sampled from each district in Satun Province.

District	Goat population[a]	Goats examined (%)	Smallholder goat farms[a]	Farms sampled (%)	Farms with positive goats (%)
La Ngu	7,183	426 (5.9)	1,473	80 (5.4)	69 (86.3)
Thung Wa	3,593	200 (5.6)	731	40 (5.5)	32 (80)
Tha Phae	1,864	100 (5.4)	364	25 (6.9)	21 (84)
Muang	1,839	100 (5.4)	387	25 (6.5)	20 (80)
Khuan Kalong	1,685	100 (5.9)	382	25 (6.5)	17 (68)
Ma Nang	679	50 (7.4)	86	5 (5.8)	3 (60)
Khuan Don	539	50 (9.3)	33	2 (6.1)	2 (100)
Total	17,382	1,026 (5.9)	3,456	202 (5.8)	164 (82)

[a] Animal census of Thailand in 2005 by the Department of Livestock Development, Ministry of Agriculture, Thailand

Goat types

Meat goats were local breeds and were generally kept outside in low-input systems with little supplementary feeding. Dairy goats were kept indoors due to their market value and milking activity. Most dairy goats examined in this study consisted of pure breeds, such as Alpine, Anglo-Nubian and Saanen.

Grazing systems

The goats were reared under management systems ranging from intensive (no grazing) to extensive (grazing) for dairy and meat goats, respectively. Under intensive management, dairy goats are mainly stall-fed, with herbage placed on the floor or hung in a shed, but sometimes they are tethered on nearby pasture during dry periods. Under extensive management, meat goats are exclusively tethered on communal grazing grounds and browse on vast pastures and bushes shared by other flocks.

Fecal sample collection

Fecal samples were obtained directly from the rectum and each sample was then placed in a separate plastic bag, labeled, packed and dispatched in a cooler box to the laboratory of the Department of Parasitology, Faculty of Veterinary Medicine, Kasetsart University, where samples were stored at 4°C until examined.

Fecal examination technique

Fecal samples were examined individually for GI nematode, cestode, and trematode eggs, as well as protozoal trophozoites and cysts or oocysts. These samples were subjected to formalin-ethyl acetate centrifugal sedimentation; *ie* 1 g fecal samples were mixed with 10 ml normal saline and centrifuged at 500×g for 3-5 minutes. The sediment was separated and mixed with 10 ml of 10% formalin and ethyl acetate and again centrifuged for 5 minutes at 500×g. The recovered sediment was then examined under a light microscope.

Statistical analysis

For the univariate analysis, the χ^2-test was used to assess associations between positivity and risk factors, such as breed, sex, age, and district. The odds ratio (OR) and confidence interval of each risk factor were calculated using the category with the lowest prevalence as baseline. Multivariate logistic regression was used to assess the interaction between positive samples, breed, and sex.

Results

Nematodes observed included strongyles, *Trichuris* spp, *Capillaria* spp, and *Strongyloides* spp, and the cestode parasites included *Moniezia benedeni*, *M. expansa* and *Avitellina* spp, which were identified by egg morphology. Trematodes present included *Eurytrema* spp and rumen flukes. Most samples contained strongyles, followed by *Entamoeba* spp and coccidians (*Eimeria* spp) (Table 2).

Most samples, 784 of 1,026 (76.4%), were positive for helminthic or protozoal parasites (Table 3). Among infected hosts, only 20.3% were positive for a single parasite. Adult goats had more strongyle infections, which were often mixed with other helminths or protozoa.

Several factors were associated with a higher prevalence of parasitic infection. There was a significantly higher prevalence of GI-parasitic infections among meat (94.3%) than dairy (47.7%) goats (OR = 1.75; 95% CI = 1.19, 2.72; $p < 0.001$). Higher GI-parasitic prevalence was observed among goats aged < 1 year (94.9%) than goats aged 1-2 years (75.4%) or > 2 years old (51.4%) (for 1-2 years, OR = 2.29; 95% CI = 1.15, 4.55; $p < 0.025$; for > 2 years, OR = 3.67; 95% CI = 1.59, 8.46; $p < 0.003$). Geographically, the GI-parasite prevalence in the seven districts ranged from 60% in Khuan Don to 86.4% in La Ngu (OR = 3.67; 95% CI = 1.59, 8.46; $p < 0.003$). The prevalence of GI parasites among male goats (82.8%) was higher than among females (75.3%), but without statistical significance.

Discussion

A comprehensive knowledge of parasite ecology is crucial to their sustainable control,

Table 2 Parasites and their stages, identified in goats of Satun Province.

Parasite	Stage of identification	Positive samples (% of positive samples)
Nematodes		
Strongyles	egg and larva	617 (78.7)
Trichuris spp	egg	58 (7.4)
Capillaria spp	egg	4 (0.5)
Strongyloides spp	egg	2 (0.3)
Trematodes		
Eurytrema spp	egg	10 (1.3)
Rumen flukes	egg	133 (16.9)
Cestodes		
Moniezia benedeni	egg	76 (9.7)
Moniezia expansa	egg	12 (1.5)
Avitellina spp	egg	1 (0.1)
Protozoa		
Coccidia (*Eimeria* spp)	oocyst	455 (58)
Giardia spp	cyst	41 (5.2)
Entamoeba spp	cyst and trophozoite	296 (37.8)

because parasites interact differently with hosts in specific climatic, management, and production environments [5,15,16]. Our data indicated that GI parasitic infections in goats from Satun Province were common, with an overall prevalence of 76.4%. Climatic conditions, particularly rainfall, are frequently associated with differences in the prevalence of GI-parasitic infections, because free-living infective stages (eggs, larvae, cysts, and oocysts) survive longer in moist conditions [17]. In addition, southern Thailand has a long rainy season (6 months), which facilitates parasite survival in the environment. This tropical zone was found to have a significant influence on the risk of GI-parasitic infections, and to be a predisposing factor for many goat parasites [18,19].

Differences in parasitic GI infections between goat breeds have been reported [20]. In Thailand, meat goats are usually reared under semi-intensive conditions, whereby animals may be brought out to graze in the morning, penned and fed, or tethered in vegetation near homesteads (particularly during crop harvest). Major differences were found in the behavior of the two breed types (meat and dairy goats) during this study. Meat goats spent more time in the environment, and were thus possibly exposed to more parasites in the environment. In contrast, dairy goats were usually kept indoors without grazing or browsing during lactation. Therefore, it was not surprising that meat goats in this study had significantly higher prevalence of infection (94.3%) than milk goats (47.7%).

Others have suggested that female goats appear to be more susceptible than male goats to protozoan parasitic infections [21]. However, in this study, higher prevalence of parasitic infection was not associated with sex ($p > 0.05$) and, although not statistically significant, males actually had a higher prevalence than females.

Although climatic conditions are consistent among all seven districts of Satun Province, the prevalence of GI parasites in goats varied from 60% in Khuan Don District to 86.4% in La Ngu. These geographical differences in prevalence might be due to the population densities of dairy goats in

Table 3 Factors associated with GI parasitic infections of goats in Satun Province.

Factor	Category	Number examined	Number positive (%)	OR (95% CI)	P-value
Breed	Meat	632	596 (94.3)	-	
	Dairy	394	188 (47.7)	1.75 (1.19, 2.72)	0.001
Meat	Males	123	114 (92.7)	-	
	Females	509	482 (94.7)	1.00	
Dairy	Males	34	16 (47.1)	-	
	Females	360	172 (47.8)	1.00	
Total	Males	157	130 (82.8)	-	
	Females	869	654 (75.3)	1.96 (0.92, 4.15)	0.106
Age	< 1 year	371	352 (94.9)	-	
	1-2 years	398	300 (75.4)	2.29 (1.15, 4.55)	0.025
	> 2 years	257	132 (51.4)	3.67 (1.59, 8.46)	0.003
District	Khuan Don	50	30 (60)	-	
	Khuan Kalong	100	66 (66)	1.02 (0.47, 2.72)	0.212
	Thung Wa	200	138 (69)	1.32 (0.66, 3.92)	0.112
	Muang	100	70 (70)	1.61 (0.71, 4.15)	0.076
	Tha Phae	100	74 (74)	2.29 (1.22, 4.94)	0.025
	Ma Nang	50	38 (76)	2.75 (1.19, 6.34)	0.017
	La Ngu	426	368 (86.4)	3.67 (1.59, 8.46)	0.003
Infection	Single	1,026	159 (20.3)	-	-
	Mixed	1,026	625 (79.7)	-	-

these districts. For example, Khuan Don, which had a lower prevalence of GI parasite infections, also has a larger dairy goat population than La Ngu, which had the highest.

Ruminant livestock may have many different GI parasites, but only a few cause major problems: strongyles, rumen flukes, *Moniezia* spp and coccidians. However, GI parasitic infections among grazing livestock frequently comprise a mixture of species, and it is conceivable that multiple infections with 'benign' species could collectively lead to chronic illness. Our study indicated that goats in Satun were usually infected with multiple helminthic and protozoal parasites. Economic evaluations have consistently shown that major losses due to parasitism affect animal production rather than mortality, and in Satun, parasitism could influence productivity, morbidity and mortality [6]. Parasite-nutrient interactions are probably exacerbated by the effects of poor nutrition and management practices, leading to decreased efficiency in feed utilization.

Young animals had a higher prevalence of coccidial infections and higher oocyst numbers in this study. This finding was consistent with other reports, and it was not surprising because naive young and adult carriers frequently graze the same areas. The intensity of infection is reportedly related to hygiene level [22]. Thus, better hygiene and separate grazing for different age groups would likely reduce coccidian shedding, the rate of infection, and the prevalence of coccidiosis among goats in Satun. Although infection intensity was lower among adult goats than kids and yearlings, the prevalence of helminthic infections was higher among adults. This result suggested that adult goats could be an important factor in distributing helminthic infections among herds.

In conclusion, most goats examined in this study harbored GI parasite infections. The differences observed in the prevalence of parasitic infections between meat and dairy goats are probably due to differences in management systems. Anthelminthic treatment programs would likely be beneficial, with the caveat that drug administration should be overseen to ensure utilization of appropriate drug classes and dosages, to minimize the development of drug resistance among parasite populations.

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