



## **Descriptive Prevalence of Gastrointestinal Parasites in Goats from Small Farms in Bangkok and Vicinity and the Associated Risk Factors**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors LMA, KP and SP designed the study and performed the statistical analysis. Author LMA wrote the first draft of the manuscript. Author SP managed the analyses of the study. Authors LMA and SJ managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The objectives of this preliminary study were to assess the prevalence of gastrointestinal parasites in goats from sixteen (n=16) selected small farms around Bangkok and vicinity, and in addition, to provide the infection characterization based on parasite egg's morphology in this central region of Thailand. A total of 185 goats (dairy and meat) aged between 6 to 30 months were involved in this study. Fresh fecal samples were collected directly from goats' rectum during the sampling period from September to October 2014. Fecal samples were examined for eggs and cysts of parasites

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byfloatation method with saturated salt solution and counted by Modified McMaster technique. Total flock prevalence for this sampling area was 100% with 68.65% individual prevalence. From total animal, 29.73% were involved with mixed infection and 28.65% and 10.27% were infected with single type of parasites; helminth and protozoa, respectively. The prevalence according to the species based on egg's morphology were; nematodes including strongyles group (52.43%) and *Strongyloides papillosus* (16.76%), cestodes including *Moniezia expansa* (5.41%) and protozoa including *Giardia* spp. cyst (5.95%), *Entamoeba* spp. cyst (24.32%) and unsporulated coccidian oocyst, *Eimeria* spp. (41.08%). The present study has confirmed the infection of gastrointestinal parasites in Bangkok and vicinity with strongyle group as a dominant species. There were also two significant risk factors related to infection; goats' gender and type of goat reared in farms ( $P<0.05$ ).

**Keywords:** Prevalence; gastrointestinal parasites; small farms; goats; Bangkok and vicinity; risk factors.

## 1. INTRODUCTION

Goat production is important as goat's meat and milk are major commodities of the global livestock sector [1,2]. Meat and dairy products are consumed by human; thus, this goat production is also improving the local farmers' economic status by providing food resources [3]. The consistently increasing trend of human population in the world has led to additional demand for animal products from time to time [4]. Same situation also occurred in Thailand as local demand for goat meat and milk is increasing [5]. Due to this economic opportunity, local farmers have developed the interest for goat husbandry even though up to now, goats' population in Thailand is still relatively small compared to other Southeast Asian countries [6]. According to the recent statistics, the population of goats in Thailand is about 450 thousand heads in 2014 [2].

While improving the goat industry, a range of diseases which resulted in goats' mortality and morbidity has affected goat production [7]. Gastrointestinal parasites infection is a serious problem worldwide, including Thailand which can affect the production and economic profit due to slow growth rate of young animals and adverse effect on the performance of adult animals [6,8,9]. Parasitic infection can cause lethality and likely to be a significant constraint for goats' productivity in Thailand [10,11].

Gastrointestinal parasitic infections in Thailand have been reported previously with most of the studies focused on the southern region [5,12]. This is because most of the goats are reared in the southern provinces as the main consumers of goat's meat and milk (Thai Muslims) are major community reside in the area. Only limited studies were conducted in the central region of

Thailand focusing on the Saraburi province [13] and another one in Nakhon Pathom province [14]. Therefore, the current study was conducted to provide the prevalence report on gastrointestinal parasite infection in Bangkok and vicinity, characterization of the parasites infection and associated risk factors.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was conducted for a period of two months from September to October 2014 in Bangkok province (13.6289°N, 100.5100°E), Thailand. Sampling area was also extended to the west of Bangkok, namely Nakhon Pathom (13.9167°N, 100.1167°E), southwest of Bangkok namely Samut Sakhon (13.5475°N, 100.2736°E), Samut Songkhram (13.4128°N, 100.0017°E) and Petchaburi (13.1106°N, 99.9464°E). A total of 16 small farms with not more than 50 animals per farm were randomly selected for the study.

### 2.2 Animal Samples

A total of 185 goats consisting of meat (crossbred of Anglo-Nubian and Thai Native) and dairy (Sannen) were involved in this study. From total number of samples, 63.78% (n=118) were females and the rest were males, 36.22% (n=67). The goats were aged between 6 to 30 months. Sex, age, type of goats, grazing system and farm management were recorded.

### 2.3 Fecal Sampling

Fecal samples were freshly collected from goats' rectum using sterile plastic glove. Each sample was placed in separate plastic bags with label before being transferred to the laboratory in a cooler box and stored at 4°C until analysis.

## 2.4 Coprological Analysis

Fecal samples were examined at the Animal Physiology Laboratory, Department of Animal Science, Faculty of Agriculture at Kasetsart University in Bangkok. The modified McMaster technique was conducted for each sample to examine parasites eggs and cysts [15]. Briefly, 3 g of feces were mixed with saturated salt (NaCl) solution. After mixed vigorously, a sample of the mixture was taken with a pipette and was transferred to one of the chambers of the McMaster slide. This procedure was repeated and the other chamber was filled up. After 30 seconds, total number of eggs under both of the etched areas on the slide was counted. The eggs were floated just below the top of the chamber. The total number of eggs in the 2 chambers was multiplied by 100 eggs to get the egg per gram (EPG) value. Each egg detected under the microscope was classified into groups of parasites based on its morphological characteristics [16,17].

## 2.5 Statistical Analysis

Data were analyzed using descriptive statistics. Prevalence of infection was determined both at the flock and individual levels at 95% confidence interval (CI). One-way analysis of variance (ANOVA) was used to examine the difference between positive and negative infection among animal samples. Chi-square test was used to analyze the risk factors related to infection and odd ratio (OR) was also determined for risk factors.

## 3. RESULTS AND DISCUSSION

All farms had at least three goats infected with gastrointestinal parasites in either mixed or single infection. Therefore, flock prevalence in this sampling area was 100% (95% CI, 69.4 – 73.3). For individual prevalence, 127 animals were infected. Thus, the infection prevalence for individual goats was 68.65% (95% CI, 61.08 – 76.22). From the total animals sampled, 29.73% were infected with mixed parasites while the rest was infected with a single type of parasites with 28.65% being infected only with helminth and 10.27% only with protozoa (Table 1). Helminths observed in the study included nematode and cestodes while no trematode was detected. The infection was also reported according to parasites groups; 32.97% of the infection were by more than one group of parasites while

35.68% were by single group of parasites (Table 2).

Based on the egg morphological characteristics, three gastrointestinal parasite types namely, nematodes, cestodes and protozoa were identified in the study (Table 3). The nematodes include strongyles and *Strongyloides papillosus* with the following prevalence rates, 52.43% (97/185) and 16.76% (31/185), respectively. The cestodes comprise of *Moniezia expansa* with a prevalence of 5.41% (10/185), while the protozoa comprise of *Eimeria* spp., *Entamoeba* spp. and *Giardia* spp. with the following prevalence rates, 41.08% (76/185), 24.32% (45/185) and 5.95% (11/185), respectively.

The study identified two risk factors that significantly ( $P<0.05$ ) influenced gastrointestinal parasitic infections in the goats, namely, gender and type of goats reared in the farms (Table 4). The odds ratios (OR) of these variables are presented in (Table 5).

Based on the egg morphological characteristics, strongyle group was the most dominant species in the current study. This is lower than previous studies in the central region [13,14] but almost similar with prevalence in the southern province [5]. As strongyle group is commonly found worldwide [18], it can be detected in goats throughout the year but might be higher during raining season. In Central Thailand, the highest rainfall is from July to October [19]. Since this study was conducted during September to October, it might be the reason for the high prevalence level of strongyle group. There is no study conducted during the dry season in Thailand and thus, comparison could not be made based on the ecological factors. It is believed that prevalence of strongyle and other internal parasites was higher in meat than dairy goats [5]. It is a common practices among local farmers in Thailand to let their meat goats out for free grazing and thus, exposing the goats to higher parasite infestations than dairy goats which are normally kept indoors [5,20].

The overall 100% flock prevalence observed in this study indicates that gastrointestinal parasite infections are widespread in Bangkok province and vicinity. However, the flock prevalence varied as one of the farms recorded only 20% prevalence. Mean flock prevalence was  $69.37 \pm 8.06$ . From the 185 goats sampled in this study, 127 goats were positive with parasite infections. The individual prevalence for this study area was

68.65%. As a comparison, this individual prevalence was lower than 99.16 and 79.47%, respectively, reported in the central region of Saraburi province [13] and at Nakhon Pathom province [14]. The high prevalence reported by [13] could be due to the samples used were solely from free grazing meat goats. The

individual prevalence recorded in this current study was nearly similar with studies conducted in southern provinces (76.4%) [5,14]. This could be because of the samples used were similar which included samples from meat and dairy goats managed under grazing and intensive systems.

**Table 1. Prevalence of gastrointestinal parasites in goats from small farms in Bangkok and vicinity**

Parasitic infection	No. of animals sampled	No. of positive samples	Prevalence (%)
Mixed infection with helminth and protozoa	185	55	29.73
Single infection with helminth	185	53	28.65
Single infection with protozoa	185	19	10.27

**Table 2. Prevalence rates of mixed and single parasite infections of meat and dairy goats from small farms in Bangkok and vicinity**

Parasitic infection	No. of animals sampled	No. of positive samples	Prevalence (%)
Protozoa + nematodes + cestodes	185	5	2.70
Protozoa + nematodes	185	50	27.03
Nematodes + cestodes	185	6	3.24
Nematodes only	185	47	25.41
Protozoa only	185	19	10.27

**Table 3. Prevalence rates and stage of different parasite species isolated from meat and dairy goats from small farms in Bangkok and vicinity**

Parasites species	Stage observed	No. of animals sampled	No. of positive samples	Prevalence (%)
<b>Nematodes</b>				
Strongyles group	Egg	185	97	52.43
<i>Strongyloides papillosus</i>	Egg	185	31	16.76
<b>Cestodes</b>				
<i>Moniezia expansa</i>	Egg	185	10	5.41
<b>Protozoa</b>				
<i>Eimeria</i> spp.	Oocyst	185	76	41.08
<i>Entamoeba</i> spp.	Cyst	185	45	24.32
<i>Giardia</i> spp.	Cyst	185	11	5.95

**Table 4. Risk factors associated with gastrointestinal parasites of meat and dairy goats from small farms in Bangkok and vicinity**

Risk factors variable	Positive infection (%)	Negative infection (%)	P-value*
<b>Gender</b>			0.008 <sup>a</sup>
Male	38 (56.72)	29 (43.28)	
Female	89 (75.42)	29 (24.58)	
<b>Type</b>			0.000 <sup>a</sup>
Dairy	44 (55)	36 (45)	
Meat	83 (79.05)	22 (20.95)	

$\chi^2$  test

<sup>a</sup>Significant difference at  $P < 0.05$

**Table 5. Odds ratios of independent variables associated with gastrointestinal parasites of meat and dairy goats from small farms in Bangkok and vicinity**

Risk factors	Odd ratio (OR)	95% confidence interval (CI)	P-value*
<b>Gender</b>			
Male	1		
Female	2.342	1.235-4.44	0.001 <sup>a</sup>
<b>Type</b>			
Dairy	1		
Meat	3.087	1.621-5.878	0.031 <sup>a</sup>

Ordinal logistic regression

P-value with same superscript showed significant difference at 0.05

Although trematodes were detected in previous reports, it was not found in the present study. Only one cestode species, namely *Moniezia expansa* (tapeworm), was detected with a prevalence of 5.41%. This is in agreement with previous studies in Thailand [5,16] even though more than one species, including *Moniezia benedeni* were found in their reports. Meanwhile, the unsporulated coccidian, *Eimeria* spp. oocyst was the most common protozoan species found (59.84%) and another species, *Giardia* spp. cyst was also detected at a prevalence of 5.95%. Protozoan prevalence in this study was almost similar with previous studies conducted in Thailand [5,13,14].

The infection rate in female goats (75.42%) was statistically higher ( $P<0.05$ ) than in the males (56.72%). Female goats were two times (OR, 2.342) more likely to get infected with gastrointestinal parasites than male goats with P-value at 0.001 (95% CI, 1.235-4.44). Gender of the animal host influenced the susceptibility to parasitic infections and this could be accredited to genetic predisposition and differential susceptibility owing to hormonal control [21]. Generally, female goats are found to be genetically more susceptible than male goats to parasitic infection [22]. Previous reports worldwide have found higher prevalence of infection in female animal host than in male such as studies conducted in Kashmir [23] and Pakistan [24]. However, there are a number of published reports worldwide, which contradicts such reports. For example, study conducted in Iran found that gastrointestinal parasitic infection rate in male goats (70.4%) was higher than in female (67.4%) but with no significant difference [25]. This kind of observation was similar to another studies conducted in India [26] and in Turkey [27]. Even a study conducted in southern part of Thailand previously found that parasitic infection in male goats were higher than female but with no statistically different [5].

Another significant factor was the type of goats reared in the farms. This variable was found to be significant ( $P<0.001$ ). Meat goats were 3 times (OR, 3.087) more likely to become infected compared to dairy goats ( $P=0.031$ , CI, 1.621-5.878). Both studies conducted previously in Thailand presented a similar result on the type of goats whereby infection in meat goats was significantly higher than dairy goats [5,14]. Normally, dairy goats receive better handling and management due to the necessity to produce a clean and high quality milk product. Appropriate management was conducted to ensure that their milk product is free from parasites [28]. Thus, farm containing dairy goats tend to have a cleaner environment compared to the farm with meat goats [5,29]. The difference between the possibilities for high parasitic infestation in meat than dairy goats due to the exposure to the environment are discussed in previous studies [29]. Farmers usually keep their dairy goats indoors with intensive feeding system while meat goats are allowed free grazing. Thus, this makes meat goats to have significantly higher infection compared to dairy goats [5].

#### 4. CONCLUSION

This preliminary study concludes that gastrointestinal parasitic infection is a widespread problem in Bangkok and vicinity in spite of the fact that the individual prevalence recorded in the present study was lower those in other previous studies conducted in Thailand with two significant risk factors detected. Further studies on analysis of farm management with extended sampling period and control methods should be conducted in the future.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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