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Prevalence and Related Factors of Pinworm Infection in Preschool Children of Ban Mai Municipal Child Development Center, Nakhon Ratchasima Province, Thailand

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Abstract

Enterobiasis or pinworm (*Enterobius vermicularis*) infection is still a public health problem among children in Thailand. Surveying pinworm infection is useful for controlling the parasite so that children in the community will have a healthy growth and better quality of life. This study aims to investigate the prevalence of pinworm infection in preschool children of the Child Development Center, Ban Mai Sub-District Municipality, Muang District, Nakhon Ratchasima Province, Northeastern of Thailand, and to analyze the related factors associated with the pinworm infection. A total of 58 samples from 2- to 4-year-old preschool children, 27 males (46.6%) and 31 females (53.4%), were collected using Scotch tape technique and examined eggs of the pinworm during September 2022. Demographic data and related factors associated with the pinworm infection were collected using questionnaires and statistically analyzed by Fisher's exact test. Prevalence of pinworm infection showed 1.72%. There was no factor significantly correlated with the pinworm infection. The pinworm infection was found with low prevalence in this study. However, this parasite should be prevented by health education and hygienic sanitization.

Keywords: Pinworm, *Enterobius vermicularis*, Preschool children, Scotch tape technique

1. Introduction

Enterobiasis is the infection of a pinworm or threadworm, Enterobius vermicularis (formerly Oxyuris vermicularis). This worm is a parasitic nematode (Family Oxiuridae) living in humans as the only one host (1). It is widespread worldwide especially in tropical zones and commonly found in preschool or primary school children (2-5). Most common site of infestation is the gastrointestinal tract. Almost all cases are asymptomatic, anal pruritus or itching which occurs primarily at nighttime while the infected people are sleeping (6).

The infection is initiated by ingestion which is contaminated with worm eggs into the gastrointestinal tract. The eggs hatch to be larvae at the small intestine and then the larvae migrate and grow to be mature worms at the large intestine. The sexual reproduction between male and female worms yields eggs which the female

worms hold to lay at the anus. Some eggs are eliminated into the environment and then transmitted to other humans. The larvae which hatch at the anus can crawl back into the large intestine as the autoinoculation (6). In addition, uncommon sites for infestation include vagina, urinary bladder, peritoneum, kidney, liver and eye (7-12). Reports showed that the worm eggs can be found in contaminated hands, clothes, utensils, toys, foods and water (1-2, 6).

Distribution of pinworm is correlated directly with crowded people and personal hygiene, especially low-income communities in temperate and tropical zones. In the temperate zone, a report of Wang et al. (13) revealed a prevalence of pinworm infection in Henan district, China in 2016 of 5.13% decreasing from 12.75% in 2006. Besides, Khan et al. (14) reported a 5.75% prevalence of pinworm infection from Malakand region, Pakistan, during May 2014 to July 2017. Moreover, Chu et al. (15) showed a 0.5% prevalence of pinworm infection from children in nurseries of Taipei City, Taiwan, in 2009.

In the tropical zone, Fan et al. (4) reported that a prevalence of pinworm infection was 12.14% from the Republic of Marshall Islands, Pacific Ocean, during October to November 2018. Besides, Chai et al. (16) revealed a prevalence of pinworm infection of 47.2% from towns near Yangon, Myanmar, in 2014.

In Thailand as a part of the tropical zone, there were also reports of pinworm infection (17-36) The prevalence of pinworm infections in children in Thailand during 2000-2019 were ranked between 0.00-21.57 % (17-36). Most study areas in Thailand were in the central region such as Angthong, Ayudthaya, Kamphaeng Phet, Nakhonnayok, Nakhon Sawan, Pathumthani, Phichit, Phitsanulok, Samut Prakarn, Suphanburi and Uthai Thani provinces (17-22, 24-25, 27-33). Furthermore, a study of Chinjarernpan et al. (36) revealed pinworm infections in children from the Nakhon Ratchasima Province. Preschool (2-4 years) children are particularly susceptible to pinworm infections because they are more likely to come into contact with contaminated surfaces and put their hands in their mouth, which can result in ingesting pinworm eggs.

Ban Mai Municipal Child Development Center is located in Mueang District, Nakhon Ratchasima Province, Thailand, where it has never been investigated for pinworm infections. The suburban area of Nakhon Ratchasima Province reported intestinal parasitic infections including pinworm infection (37). The center contained 68 preschool children which were divided into 3 classes based on age of children. Lifestyles of these children spent around 7 to 8 hours in the center each day. During this time, they engaged in a variety of activities that promoted play, exploration, and learning. These activities were designed to support their physical, social, emotional, and cognitive development. At noon, they had lunch at the center. The meal was prepared on-site or delivered from an external provider and was designed to be nutritious and age-appropriate. After lunch, they were typically expected to help with clean-up. They had a nap in the afternoon, and all the children in each class were sleeping together. Therefore, the present study aimed to investigate preschool children from this child development center, and to find related factors which significantly correlated with the pinworm infection.

2. Materials and Experiment

2.1 Study design, area, population, ethic approval and subject recruitment

A cross-sectional study was conducted to investigate a prevalence of pinworm infection in preschool children of Ban Mai Municipal Child Development Center, Muang District, Nakhon Ratchasima Province, Northeastern of Thailand (14.963018, 102.031529). This province was previously reported to have various human intestinal parasitic infections (37). The sample size was determined using Yamane's formula (38), $n = N/1 + N*e^2$, where n was the sample size, N (68) was the population size, e (0.05) was the level of precision. The minimum sample size for the calculation was 58. Although the problem of difficulty obtaining informed consent for all children, this number can still be representative of the population.

Ethical approval for this study was obtained from the Ethical Committee of Nakhonratchasima College (Reference number: NMCEC-0014/2561). A total of 58 preschool children (27 boys and 31 girls) were recruited in September 2022. A meeting was held with authorities of the child development center and parents of the children to discuss the purpose of the study and to take permission to carry out the study. An informed consent form was obtained

from participant parents/guardians with permissions for their children to participate in this study.

2.2 Sample collection and pinworm detection

Sample collection was performed after the napping of children at the development center around 3 p.m. All samples were collected using the Scotch tape technique as previously described by Graham (39), which involved adhesive the Scotch tape onto the glass and touch around the anal area of children to pick up eggs of the pinworm. The contents of the tape were transferred onto a glass slide for pinworm examination. Collected samples were transported to the laboratory in the Faculty of Allied Health Sciences, Nakhonratchasima College, and examined under light microscope. The positive for pinworm infection was considered from the samples containing eggs of the pinworm. After the detection, all positive children would be treated with the antiparasitic drugs until negative for the parasite.

2.3 Questionnaire survey

A questionnaire to collect demographic data (gender, age of children, date of collection, locality) and related factors such as symptoms involving pinworm infection (anus scratching), previous antiparasitic therapy, parent backgrounds (household income, education level and occupation) and behavioral data associated with pinworm infection (waking up at night, morning shower, nail biting, finger sucking, toy biting, hand washing, playing with friends, washing fruits and vegetables, clothes cleaning, eating unclean food, toilet cleaning, bed cleaning, household cleaning, nail cutting, and child care) were provided to collect data from the subjects.

2.4 Statistical analysis

Data were statistically analyzed using IBM SPSS version 22.0. The prevalence of pinworm infection was analyzed by correlation with demographic data and related factors associated with pinworm infection by Fisher's exact test at 95 percent confidence level.

3. Results

3.1 Demographic data

A total of 58 preschool children from Ban Mai Municipal Child Development Center, Muang District, Nakhon Ratchasima Province, Northeastern of Thailand, 27 children were male (46.6%), 31 children were female (53.4%), 5 children aged 2 years (8.6%), 37 children were 3 years (63.8%) and 16 children were 4 years (27.6%) as shown in Table 1.

Table1 Demographic data of the subjects.

Characteristics	Number	Proportion (%)
Sex		
Male	27	46.6
Female	31	53.4
Age (years)		
2	5	8.6
3	37	63.8
4	16	27.6

Mean = 3.19 ± 0.58 years, Median = 3 years, Mode = 3 years

Backgrounds of the parents such as region of hometown, household income, education level and occupation were shown in Table 2.

Table2 Background information of the parents.

Variables	n	%
Hometown (region)		
Northeast	56	96.6
North	1	1.7
South	1	1.7
Household income in Thai baht		
Low (less than 18,000)	23	39.7
Medium (18,001 - 25,000)	18	31.0
High (more than 35,000)	17	29.3
Education level		
Primary school	7	12.1
Lower secondary school	15	25.9
Upper secondary school	17	29.3
Vocational certificate	3	5.2
High vocational certificate	2	3.4
Bachelor degree	14	24.1
Occupation		
Agriculture	1	1.7
Employee	32	55.2
Freelance	7	12.1
Government officer	2	3.4
Seller/merchant	12	20.7
Others	4	6.9

3.2 Prevalence of pinworm infection in preschool children

Of 58 samples, one sample was positive for pinworm infection. This result shows a prevalence of 1.72% as shown in Table 3.

Table 3 Prevalence of pinworm infection in preschool children from Ban Mai Municipal Child Development Center, Muang District, Nakhon Ratchasima Province, Northeastern of Thailand.

Sex	Age	Number	Positive	Prevalence (%)
Male	2	1	0	0.00
	3	16	1	6.25
	4	10	0	0.00
Female	2	4	0	0.00
	3	21	0	0.00
	4	6	0	0.00
Total	**58**	**58**	**1**	**1.72**

3.3 Factors related with pinworm infection

From Fisher's exact test at the confidence level of 95%, the related factors associated with pinworm infection are shown in Table 4. All factors are not correlated with the pinworm infection such as gender, age, scratching around the anus, waking up at night, lacking of a morning shower, biting nails, sucking fingers, biting toys, lacking of hand washing, playing with friends, lacking of clean clothes, lacking of clean bedding, inadequate household cleaning, lacking of cutting nails short, and lacking of child care ($p > 0.05$).

Table 4 Correlation of pinworm infection with demographic data and related factors.

Demographic data and related factors	Number	Positive	Prevalence	*p*-value
Gender				
Male	27	1	3.70	0.466
Female	31	0	0.00	
Age of children (year-old)				
2	5	0	0.00	1.000
3	37	1	2.70	
4	16	0	0.00	
Scratching around the anus				
Yes	21	1	4.76	0.362
No	37	0	0.00	
Waking up at night				
Yes	23	1	4.35	0.397
No	35	0	0.00	
Lacking of a morning shower				
Yes	13	1	7.69	0.224
No	45	0	0.00	
Biting nails				
Yes	25	1	4.00	0.431
No	33	0	0.00	
Sucking fingers				
Yes	20	1	5.00	0.345
No	38	0	0.00	
Biting toys				
Yes	25	0	0.00	0.569
No	33	1	3.03	
Lacking of hand washing before eating				
Yes	5	0	0.00	0.914
No	53	1	1.89	
Playing with friends				
Yes	48	1	2.08	0.172
No	10	0	0.00	
Eating fruits and vegetables without washing				
Yes	6	1	16.67	0.103
No	52	0	0.00	

Demographic data and related factors	Number	Positive	Prevalence	*p*-value
Lacking of clean clothes regarding				
Yes	8	0	0.00	0.862
No	50	1	2.00	
Eating unclean and uncooked food				
Yes	4	1	25.00	0.069
No	54	0	0.00	
Lacking of toilet hygiene				
Yes	7	1	14.29	0.121
No	51	0	0.00	
Lacking of clean bedding				
Yes	19	1	5.26	0.328
No	39	0	0.00	
Inadequate household cleaning				
Yes	10	0	0.00	0.845
No	48	1	2.08	
Keeping fingernails long				
Yes	17	0	0.00	0.293
No	41	1	2.44	
Lacking of child care				
Yes	7	0	0.00	0.879
No	51	1	1.96	
Household income < 18,000 baht				
Yes	17	1	5.88	0.293
No	41	0	0.00	

4. Discussion and conclusion

Prevalence of pinworm infection is various (0.00-38.82%) significantly in different areas in Thailand (17-36). The present study confirmed the existence of pinworm infection in Ban Mai Municipal Child Development Center, Muang District, Nakhon Ratchasima Province, Northeastern of Thailand, through detection using the Scotch tape technique. It appears that a positive sample was obtained from a 3-year-old boy, indicating the presence of pinworm eggs. The background information of the parents showed poverty and limited education. Their household income of 12,000 baht/month and education level of lower secondary school indicate a relatively low income, which may make it difficult for them to provide for their family's basic needs, including healthcare. The infected child and his family were given a dose of albendazole (200 mg) and followed up after post-treatment for one week.

The lower prevalence in 3-year-old children in this study (6.25%) compared to the same age in a study of Changsup (9.82%) (21). Moreover, the lower prevalence (1.72%) in the children aged 2-4 years in this study is lower than other studies which performed in the same ages of children (1.85-9.9 %) (27, 30, 35, 36).

It appears that there were no related factors of pinworm infection in the present study. However, other factors such as scratching around anus (13), biting nails (31), sucking fingers (29, 35), hand washing before eating (13), lack of clean clothes (19) and bedding (19), and keeping fingernails long (35), have also been suggested as related factors for pinworm infection. These factors can increase the likelihood of exposure to pinworm eggs, which can be easily transferred from contaminated surfaces to the mouth and digestive tract.

The appropriate time for pinworm sample collection is usually in the morning, before the children take a bath. This is because pinworm eggs are laid around the anus during the night, and collecting samples in the morning increases the chances of finding them (6). However, collecting a sample in this study cannot performed mentioned above. This reason may be a limitation for pinworm detection in this study.

While the Scotch tape technique remains the gold standard for pinworm

detection, its sensitivity can be limited (40). Alternative diagnostic methods may be considered in cases where the Scotch tape technique is not effective. For example, stool examinations or PCR-based tests may provide higher sensitivity and specificity such as a nested-PCR developed by Ummarino et al. (5).

In conclusion, the prevalence rate of pinworm infection was relatively low in Nakhon Ratchasima Province, maybe due to considerably improved public health. However, the infection control measures in this population should be aware of the transmission of pinworm even from eating clean or boiled food, and keeping the toilet clean and hygiene. Furthermore, the expanded study areas to other provinces in the Northeastern region of Thailand are required to know the problems and decrease pinworm infections in this region.

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Declaration of conflicting interests

The authors declared that they have no conflicts of interest in the research, authorship, and this article's publication.

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