

## PINWORM INFECTION PREVALENCE AND ASSOCIATED FACTORS AMONG CHILDREN AGED 1 TO 5 IN KRONG PAC DISTRICT, DAK LAK PROVINCE IN 2023

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### ABSTRACT

Background: Pinworm is globally prevalent nematode worm often found in children, causing symptoms such as anal itching, digestive disturbances, and physical discomfort caused by the worms migrating. In Vietnam, the prevalence of pinworm infection among children is noticeable in most provinces and cities, with infection rates ranging from 10.6% to 26.9%. However, previous researches predominantly concentrated on school-going children, with limited investigation into children residing in households. Methods: this study employed two sequential research designs. First, a cross-sectional study was conducted in households, involving 1031 children aged 1 to 5 years, to determine the prevalence of pinworm infection. Subsequently, a case-control study was performed with 129 children in the case group and 258 children in the control group to investigate the environmental and personal hygiene factors associated with pinworm infection. The Graham technique was employed to identify children infected with pinworms, and a structured questionnaire was used to gather information about the population characteristics and exposure factors of the children. Statistical analysis techniques such as the Chi-square test and multivariable logistic regression were applied to establish the relationship between exposure factors and pinworm infection. Results: the study revealed that the prevalence of pinworm infection, was found to be 12.5% (with a confidence interval of 10.5% to 14.5%). Notably, the infection prevalence in boys (16.0%) was higher than in girls (7.9%). Several risk factors associated with worm infection were identified, including practices such as handwashing before eating and after playing, the use of hand and bath soap, cleaning of children's toys, and the deworming status of caregivers. Conclusion: pinworm infection in children remained a prevalent issue in the region and was primarily linked to personal hygiene practices.

**Keywords:** *pinworm infection prevalence, risk factors, children 1-5 years old.*

### 1. INTRODUCTION

The Pinworm, scientifically known as *Enterobius vermicularis*, is a nematode worm that is widespread worldwide. Pinworms undergo a straightforward developmental cycle that is heavily reliant on personal hygiene practices. Children are more prone to pinworm infections compared to adults. Pinworm disease is a global concern, with higher prevalence rates in developing countries. For instance, in Myanmar, the infection prevalence was as high as 47.2% (Chai, 2015); in Iran, it ranged from 2.3% to 24.1% (Mahmood, 2017), and in Palestine, it was approximately 22.1% (Rasha, 2015). In contrast, developed countries report lower rates, such as South Korea with a range of 1.8% to 2% (Hyejoo Shin, Jung, Ryoo, 2021) and Bulgaria with 1.5% (K. Stoyanova, et al., 2020). In Vietnam, pinworm infections were prevalent in many provinces and cities, including Cu Chi district in Ho Chi Minh City (23.8% - Phung, Hoa, Hong, 2018) and Pleiku city in Gia Lai province

(10.6% - Trang, 2021). In Dak Lak province, several studies have reported pinworm infection prevalences among preschoolers ranging from 17.6% to 26.9%. Factors associated with pinworm infection such as thumb sucking, nail biting, poor house hygiene, children's toys, education level and occupation of caregivers varied across study areas. (Binh, 2021; Dang, 2021; Nhat, 2020). Notably, most studies on pinworm infections focus on children attending schools. However, there are regions, like Krong Pac district, where not all children under 5 years old have access to formal education or kindergarten facilities. Consequently, a study was conducted with two main objectives: (i) to determine the prevalence of pinworm infection among children aged 1 to 5 years within the Krong Pac district community, and (ii) to identify factors associated with pinworm infection in this age group within the study area.

### 2. CONTENTS AND METHODS

#### 2.1. Contents

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- A cross-sectional study involving 1,050 children aged 1 to 5 years, selected from households, was conducted to ascertain the prevalence of pinworm infection using the Graham's tape method.

- A case-control study involving 387 children, with 129 children in the case group and 258 children in the control group, was undertaken to identify factors linked to pinworm infection. Data collection involved a structured questionnaire administered through observations and interviews with parents or caregivers.

## 2.2. Methods

### - Participants, Study Duration, and Research Location

Krong Pac district is situated in the eastern region of Dak Lak province, approximately 30 kilometers from Buon Ma Thuot city, accessible via Highway 26, which links to Khanh Hoa and the Central Coast provinces. Covering an expanse of 62,581 hectares, Krong Pac district is subdivided into 16 administrative units comprising one town and 15 communes. The district is home to a population of approximately 196,000 residents, representing a rich tapestry of 23 diverse ethnic groups coexisting harmoniously within its borders.

The research was carried out within the timeframe of April 2023 to August 2023, focusing on households within Krong Pac district, situated in Dak Lak province.

Selection criteria encompassed children aged 1 to 5 years with parental or caregiver consent to partake in the study. Exclusion criteria comprised children who had received deworming treatments within the preceding 2 months and children who were absent from home during the sampling period.

### - Research Designs

We performed 2 consecutive study designs: (i) a cross-sectional study to determine the prevalence of pinworm infection and (ii) a case-control study to determine factors associated with pinworm infection.

### - Sample size

In the context of the cross-sectional study, calculations were conducted following the formula for estimating a proportion with a 95% confidence level ( $\alpha=0.05$ ). The calculations considered a marginal error (d) of 0.05, an anticipated prevalence of pinworm infestation (p) at 0.269, as reported by Le Hai Dang et al, and accounted for a design effect (DE) of 2, attributable to the utilization of cluster sampling selection methods

$$n \geq DE \times \frac{z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

Substituting the parameters into the above formula, we get a sample size of 948. Expecting a sample loss of about 10%, the sample size for the study is 1050.

In the case of the case-control study, sample size calculations were performed using the formula designed for estimating sample sizes in case-control studies. These calculations took into consideration a type 1 error probability ( $\alpha$ ) of 0.05, a type 2 error probability ( $\beta$ ) of 0.2, a prevalence of the incorrect practice in the pinworm-free group ( $p_1$ ) set at 0.6, as per Dang Dinh Thanh et al., an odds ratio (OR) of at least 2, and a disease-to-control ratio of 1:2.

$$n_{case} \geq \frac{[Z_{1-\alpha/2}\sqrt{(r+1)p(1-p)} + Z_{1-\beta}\sqrt{rp_1(1-p_1) + p_2(1-p_2)}]^2}{r(p_2 - p_1)^2}$$

$$p_2 = \frac{p_1 OR}{1 + p_1(OR - 1)}$$

$$n_{control} = n_{case} \times r$$

By plugging the parameters into the formula, we required 112 cases and 224 controls. However, based on the findings of the cross-sectional study, we included 129 children with pinworm infection and 258 children without pinworm infection.

### - Sampling

#### Sampling in cross-sectional study

The research subjects were incorporated into the sample utilizing a cluster sampling technique based on the principle of probability proportionate to size (PPS). This process unfolded in two sequential steps:

Step 1: A cluster sample was initially chosen, with the cluster unit representing villages, village sections, or residential groups. Specifically, 30 clusters were randomly selected from a pool of 236 clusters. Subsequently, a sampling frame was constructed, which included sample units encompassing villages, residential groups, and the cumulative population of children aged 1 to 5 years corresponding to each cluster. The total count of children aged 1 to 5 years within the district amounted to 14,640. To determine the sample distance (denoted as "K"), we divided the cumulative total number of children by the 30 clusters, yielding a value of  $K = 488$ .

To select the first cluster (i), a random number was generated within the range of 0001 to 488. The subsequent clusters were then included in the sample at intervals of K, namely i, i + K, i + 2K,

and so forth, up to  $i + 29K$ .

Step 2: The process entailed determining the number of research children to be included within each cluster. Specifically, each cluster required 35 children (totaling 1050 children across the 30 clusters). To achieve this, a comprehensive list of children aged 1 to 5 years, currently residing in the 30 clusters selected in step 1, was compiled. Subsequently, 35 children were selected for each cluster using a simple random sampling approach.

#### - Sampling in case control study

Based on the findings of the cross-sectional study, all 129 children diagnosed with Pinworm infection were assigned to the disease group, while 258 children without Pinworm infection were chosen for the control group. The selection process adhered to a 1:2 ratio and was executed through a simple random sampling procedure, utilizing a list of non-infected children for reference.

#### - Key variables

**Dependent Variable - Pinworm Infection Status:** This variable comprises two categories - infected and uninfected, ascertained using the Graham technique for detecting pinworm eggs.

**Independent Variables -** These encompass factors associated with personal hygiene behavior and household environment, determined through a combination of observations and interviews.

**Demographic Variables -** This set includes the child's age, gender, ethnicity, as well as the caregiver's level of education and family income, obtained through interviews.

#### - The methods of data collection

**Pinworm Egg Detection Procedure in Children from Chosen Residences (Graham Technique):** A trained technician conducted the perianal tape test in the morning prior to the child's anal cleaning routine. Subsequently, the tapes were dispatched to the Laboratory at the District Medical Center for examination. Pinworm eggs were scrutinized using an optical microscope with medium illumination and a 100-fold magnification.

The approach chosen for data collection involved direct interviews and observations of the child's caregiver within their homes, employing a structured questionnaire. This questionnaire comprised two sections: the first encompassed 7 questions regarding the child's and parents' demographic characteristics, while the second involved 17 questions and observations related to personal hygiene practices, household cleanliness, and any history of deworming medication use over

the preceding 6 months.

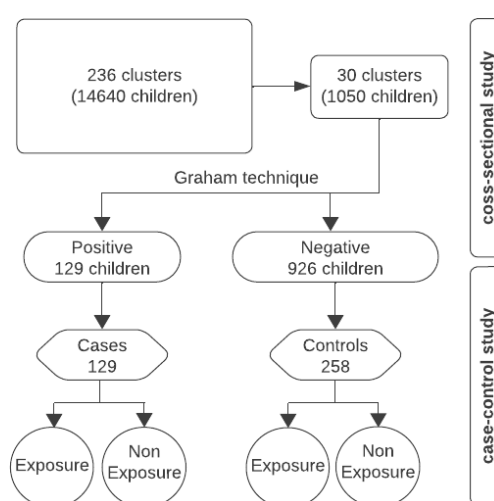
#### - Data processing and analysis methods

The data were inputted into Epidata 3.1 software and subsequently subjected to analysis using Stata 10.0 software. The Pinworm infection prevalence was depicted as a percentage along with its frequency, and 95% confidence intervals were provided. We assessed variations in Pinworm infection prevalence across demographic factors (e.g., age, gender, etc.) using Chi-square testing.

In the case-control study, we initially conducted univariate analysis to examine associations with each exposure factor. Variables demonstrating a significance level of  $p \leq 0.20$  were then selected for inclusion in a multiple analysis. Subsequently, we computed the odds ratios (OR) along with their corresponding 95% confidence intervals (95%CI).

#### - Ethics in research

The study included children aged 1 to 5 years, and parental or caregiver consent was a prerequisite for their participation, with the understanding that they could opt out at any point during data collection. We ensured the confidentiality of the children's personal information, emphasizing that the data collected were solely for research purposes and would not be used for any other purposes. Additionally, in collaboration with the commune health station, children aged 2 years and older found to be infected with Pinworms were provided with consultations and free deworming treatment as part of our project's efforts, overseen and monitored by our project staff.



**Diagram 1. Research sampling process**

### 3. RESULTS AND DISCUSSION

#### 3.1. Prevalence of Pinworm Infection in Krong Pac district

The results displayed in Table 1 reveal that the prevalence of Pinworm infection among children aged 1 to 5 years stood at 12.5% (95% CI of 10.5% to 14.5%). Notably, this prevalence remained uniform across all 16 communes under

examination. Although the prevalence of Pinworm infection in our study area was comparatively lower than in other regions, it still posed a significant concern, impacting approximately 1 in 10 children.

**Table 1. Prevalence of Pinworm Infection in the Examined Communities**

Commune	Number	No positive	Proportion (%)	95% CI
Ea Phe	104	11	10.6	4.6 – 16.6
Hoa Dong	69	9	13.0	4.9 – 21.2
Ea Knuéc	103	11	10.7	4.6 – 16.7
Ea Kenh	70	9	12.9	4.8 – 20.9
Ea Yong	103	16	15.5	8.4 – 22.7
Phuoc An	69	8	11.6	3.8 – 19.3
Hoa An	70	11	15.7	7.0 – 24.5
Krong Buk	68	10	14.7	6.1 – 23.3
Ea Kly	102	10	9.8	3.9 – 15.7
Ea Hiu	35	8	22.9	8.2 – 37.5
Hoa Tien	33	3	9.1	1.3 – 19.4
Tan Tien	34	6	17.6	4.1 – 31.2
Ea Uy	34	2	5.9	2.5 – 14.2
Ea Yieng	34	4	11.8	0.9 – 22.6
Ea Kuang	33	5	15.2	2.2 – 28.1
Vu Bon	70	6	8.6	1.8 – 15.3
<b>Total</b>	<b>1031</b>	<b>129</b>	<b>12.5</b>	<b>10.5 – 14.5</b>

Research findings regarding the prevalence of Pinworm infection in the studied area compared to neighboring regions reveal notable disparities. In Lak district in 2021, Pinworm prevalence stood at 26.9% (Dang, 2021), while in Cu M'gar district in the same year, it was slightly lower at 19.9% (Binh, 2021). Similarly, in Ea Phe commune, Krong Pac, in 2020, the prevalence recorded was 17.6% (Nhat, 2020). However, when juxtaposed with Pleiku City, Gia Lai province, in 2021, the prevalence exhibited a similar prevalence of 10.6% (Trang, 2021). This disparity in prevalence may be attributed to our research's inclusion of households with young children who have not yet started school, potentially reducing their exposure to Pinworm infection risk factors typically found in more crowded educational settings like daycares and kindergartens. These findings underscore the variability of Pinworm prevalence, highlighting the influence of the studied population and their living conditions. Despite the lower prevalence observed in our research, it's important to note that Pinworm infectious prevalence in our study area remains notably higher when compared to developed countries such as Korea in 2021 (ranging from 1.8% to 2%, Hyejoo, 2021) and Bulgaria in 2020 (1.5%, K. Stoyanova, 2020).

### **3.2. Prevalence of Pinworm infection according to demographic characteristics**

Age: the results show that (Table 2) the prevalence of Pinworm infection varied among different age groups of children. The highest prevalence of Pinworm infection was in the group of 4-year-old children (16.5%), while the lowest infection prevalence was recorded in the group of 1-year-old children (98.7%). The result from our study was similar to the study in northern Iran, where the prevalence of Pinworm infection was the highest in 4-year-old children (20.8%) compared to other age groups (Seyed, 2016).

The higher prevalence of Pinworm infection in 4-year-old children compared to other age groups can be attributed to several factors: (i) Behavior and Hygiene: At the age of 4, children are often more hyperactive and less aware of good personal hygiene practices than older children. Their tendency to touch various surfaces and objects and then put their hands in their mouths increases the risk of ingesting Pinworm eggs, which can lead to infection; (ii) Close Contact: Young children tend to have closer physical contact with peers and caregivers, which facilitates the transmission of Pinworms since these parasites are highly



contagious and can easily spread through contact with contaminated hands, clothing, or bedding.

**Gender:** Research results in table 2, it is observed that the prevalence of Pinworm infection among male children is higher than that among female children. specifically, the prevalence among male children is 16.1%, while among female children, it is 7.8%. Our results were similar to research in Korea in 2021, it was found that the prevalence of Pinworm infection in boys (1.8%) was higher than in girls (1.3%) (Hyejoo, 2021); to research in Lak district in 2021 revealed that the prevalence of Pinworm infection in boys and girls was 29.2% and 24.5%, respectively (Dang, 2021); However, In a study conducted in Ea Phe commune, Krong Pac district, in 2020, the prevalence of Pinworm infection in boys (15.1%) was lower than in girls (20.8%) (Nhat, 2020). These findings suggest that the prevalence of Pinworm infection can vary by location and time, with different studies reporting different gender-specific prevalences.

**Ethnicity:** Research findings suggest that the prevalence of pinworm infection was similar among different ethnic groups. Specifically, the Kinh ethnic group had an infection prevalence of 12.2%, the Ede ethnic group had a prevalence of 12.4%, and other ethnic groups had a prevalence of 14.6%. However, it's noted that previous studies in specific regions showed variations. For instance, in Ea Phe commune, Krong Pac district, the Kinh ethnic group had a prevalence of 15.1%, while ethnic minorities had a prevalence of 21.7% (Nhat, 2020). Similarly, in Cu Mgar district in 2021, the Kinh ethnic group had a prevalence of 14.8%, and ethnic minorities had a prevalence of 23.8% (Binh, 2021). These variations could be attributed to sample selection and environmental factors, suggesting that ethnic differences in pinworm infection may not be significant. Therefore, public health interventions should target all ethnicities for improved community health.

**Table 2. Prevalence of pinworm infection according to demographic characteristics**

Variables	Number	No positive	Proportion (%)	95% CI
<b>Children's age group</b>				
1 years old	138	12	8.7	4.0 - 13.4
2 years old	205	21	10.2	6.1 - 14.4
3 years old	216	31	14.4	9.6 - 19.1
4 years old	273	45	16.5	12.1 - 20.9
5 years old	199	20	10.1	5.8 - 14.3
<b>Children's gender</b>				
Girl	444	35	7.9	5.4 - 10.4
Boy	587	94	16.0	13.0 - 19.0
<b>Children's ethnicity</b>				
Kinh	678	83	12.2	9.8 - 14.7
E De	250	31	12.4	8.3 - 15.5
Other ethnicities	103	15	14.6	7.6 - 21.5
<b>School attendance status of children</b>				
No	383	37	9.7	6.7 - 12.6
Yes	648	92	14.2	11.5 - 16.9
<b>Education level of children's father</b>				
Illiteracy	43	6	14.0	3.2 - 24.8
High school -	447	56	12.5	9.4 - 15.6
High school +	541	67	12.4	9.6 - 15.2
<b>Education level of children's mother</b>				
Illiteracy	41	4	9.8	0.3 - 19.2
High school -	360	50	13.9	10.3 - 14.5
High school +	630	75	11.9	9.4 - 14.4
<b>Family income</b>				
non-poor households	986	123	12.5	10.4 - 14.5
poor households	45	6	13.3	3.0 - 26.7

School attendance status: our study found that the prevalence of pinworm infection in children attending school was 14.2%, which was higher than the prevalence of 9.7% in children who did not attend school. This suggests that school-going children are at a higher risk of pinworm infection compared to those who do not attend school. Preschool Environments (Preschools and kindergartens) are mentioned as places where groups of young children gather and play together. These environments are conducive to the transmission of pinworm infections due to close contact among children.

Household economic circumstances: our research findings indicate that the prevalence of pinworm infection in children from economically disadvantaged families is 13.3%, which is quite comparable to the 12.5% prevalence among children from more economically stable households. These results align with studies conducted in regions such as southern Iraq (Ruaa Khazaal, Hadraawy, Hussein, 2020) and the West Bank of Palestine (Rasha, 2015). This outcome underscores the notion that the prevention and treatment of pinworms can be achieved effectively without significant financial burden. Pinworm disease typically follows a straightforward transmission cycle, and preventive measures mainly revolve around personal hygiene, maintaining a clean living environment, and periodic deworming. These strategies are generally low-cost and can

be readily implemented by individuals across communities. Additionally, the medications used to treat pinworm infections are often highly effective and affordable, further contributing to the effective prevention and management of the disease without imposing undue financial strain on communities.

Regarding the educational levels of parents, our research findings indicated that the prevalence of pinworm infection in children remained consistent across groups categorized by their fathers' and mothers' educational levels. These results align with similar studies, such as the one conducted in Lak district, Dak Lak province in 2021 (Dang, 2021), and in Marshall Island in 2021 (Chia, 2021). However, a discrepancy emerged when compared to research in Cu Mgar in 2021 (Binh, 2021) and Pleiku City, Gia Lai province (Trang, 2021), where children raised by individuals with lower educational backgrounds exhibited a higher incidence of Pinworm infection than those raised by parents with higher educational attainment. It is our belief that the influence of educational level on Pinworm prevalence may vary based on the local living environment and specific conditions. In other words, educational level may not be a sole determining factor for Pinworm infection. Importantly, Pinworm disease can be effectively managed and prevented through simple measures that promote personal hygiene and family-based disease prevention practices.

### 3.3. Risk factors associated with pinworm infection

**Table 3. Multivariate analysis of associations of pinworm infection with risk factors**

Variables	Number	No positive (%)	COR	AOR (95% CI)	P value
<b>Gender</b>					
Girl	164	35 (21.1)	1	1	
Boy	223	94 (42.2)	2.7	2.6 (1.4 – 4.7)	<0.01
<b>Clean mats/bed sheets regularly</b>					
Yes	190	50 (26.3)	1	1	
No	197	79 (40.1)	1.9	1.9 (1.1 – 3.5)	0.03
<b>Clean children's toys regularly</b>					
Yes	204	43 (21.1)	1	1	
No	183	86 (46.9)	3.3	4.0 (2.2 – 7.3)	<0.01
<b>Wash children's hands before meals</b>					
Yes	203	36 (17.7)	1	1	
No	184	93 (50.5)	4.7	5.9 (3.3 – 10.9)	<0.01
<b>Wash children's hands after playtime</b>					
Yes	230	44 (19.1)	1	1	
No	157	85 (54.1)	4.9	6.8 (3.7 – 12.6)	<0.01

Variables	Number	No positive (%)	COR	AOR (95% CI)	P value
<b>Utilizing hand soap</b>					
Yes	196	36 (18.4)	1	1	
No	191	93 (48.7)	4.2	2.1 (1.2 – 3.8)	<0.01
<b>Utilizing bath soap</b>					
Yes	217	52 (23.9)	1	1	
No	170	77 (45.3)	2.6	3.0 (1.7 – 5.5)	<0.01
<b>Deworming of caregivers within a 6-month period</b>					
Yes	114	26 (22.8)	1	1	
No	273	103 (33.3)	2.1	3.4 (1.7 – 6.6)	<0.01

*COR: Crude Odds Ratio AOR: Adjusted Odds Ratio*

Regarding the cleaning of mats and bed sheets, the results of the multivariate analysis indicated that children residing in households where these items are not regularly cleaned have a 1.9 times higher likelihood of worm infection (95% CI: 1.1 to 3.5) in comparison to children in households that adhere to regular cleaning practices.

The research shows a significant correlation between the cleanliness of children's toys and pinworm infections. Children in households where toys are not regularly cleaned are 4.0 times more likely to contract pinworm infections (95% CI: 2.2 to 7.3) compared to those in households where toy cleaning is routine. This finding aligns with similar studies in Lak district (Dang, 2021) and Pleiku city (Trang, 2021), where children whose caregivers don't regularly clean their toys face 1.53-fold and 1.38-fold higher infection risks, respectively. The persistence of pinworm eggs in various environments, including toys and surfaces like books and playthings (Quang, 2005), contributes to this increased risk when children come into contact with these items due to infrequent cleaning practices.

Failure to practice handwashing before meals significantly increases the risk of pinworm infection in children, with a 5.9-fold higher risk (95% CI: 3.3 to 10.9) compared to those who consistently wash their hands. This finding is consistent with research conducted in Myanmar in 2022 (Win Maw Wai, Zi Oo, 2023) and Pleiku City, in 2021 (Trang, 2021), where children who skipped handwashing had a 3.2 times higher pinworm infection prevalence. This underscores the critical importance of handwashing before meals since pinworm transmission primarily occurs from the anus to hands to mouth. Thus, if pinworm eggs are present in the environment and adhere to hands, there's a risk when children consume food or beverages. Studies have revealed frequent hand-to-mouth contact, with pinworm

eggs detected in nail samples in up to 72% of cases (Quang, 2005). Handwashing before meals plays a pivotal role in removing pathogens, including pinworm eggs.

Neglecting handwashing after playtime significantly increases the risk of pinworm infection in children, with a 6.8-fold higher likelihood (95% CI: 3.7 to 12.6) compared to those who consistently wash their hands. This finding corresponds with results from a study in Lak district (Dang, 2021), which showed a 1.42 times higher pinworm infection prevalence among those who didn't wash their hands before meals. These findings emphasize the substantial preventive impact of simple practices like handwashing after play. During play, children frequently interact with their environment and other children, increasing the chances of exposure to pinworm pathogens. Proper handwashing effectively removes pinworm eggs, offering a critical defense against infection.

Utilizing hand soap and bath soap: Children who did not use hand soap face a 2.1-fold higher likelihood of pinworm infection (with a 95% CI 1.2 to 3.8) compared to those who employ hand soap. Similarly, children who neglected the use of bath soap were at a 3.0-fold higher likelihood of worm infection (95% CI: 1.7 to 5.5) in contrast to their counterparts who utilize bath soap. These findings underscore the pivotal role of hand soap in pathogen elimination. Proper use of hand soap by children is instrumental in eradicating pathogens, including pinworm eggs, from their hands and anus, thereby aiding in the prevention of disease transmission. This constitutes a crucial component of personal hygiene maintenance and the prevention of pinworm disease, particularly in areas with elevated risk factors.

Children under the care of caregivers who haven't undergone deworming in the past 6 months face a 3.4-fold higher risk of pinworm infection

(95% CI: 1.7 to 6.6) compared to those looked after by dewormed caregivers. This underscores the importance of simultaneous deworming for both children and their caregivers to effectively control pinworm infections. It's crucial to note that if one family member has pinworms, the entire family can be at risk of infection, as shown in research conducted by Luu My Phung in Cu Chi, Ho Chi Minh City (Phung, 2018), where up to 29.5% of children with pinworm infections had family members with co-infections. Therefore, solely deworming the child without extending treatment to the whole family or those involved in the child's care at home can result in reinfection from caregivers. To prevent and control pinworm disease effectively, it's essential to implement deworming programs for both children and caregivers in the family every 6 months.

In 2023, our research took place in the Krong Pac district of Dak Lak province, with a primary focus on 1,031 children aged 1 to 5 years. These children were systematically selected from 30 distinct clusters, each corresponding to a specific village or community group within the district. To ensure comprehensive coverage of all research subjects in the region, we employed the Probability Proportional to Size (PPS) sampling method across all 236 clusters. In our quest to identify pinworm infections in these children, we utilized the tape technique developed by Graham and conducted examinations in the morning. With a substantial sample size, the application of representative sampling methodologies, and the use of standardized pinworm infection detection techniques, our results attain a high level of reliability and effectively represent the broader community. These study findings can be extrapolated to apply to other regions within the Central Highlands that share comparable socio-economic conditions.

Furthermore, through a subsequent case-control study, we identified eight independent risk factors associated with pinworm infection. These

risk factors encompassed male gender, irregular cleaning of mats and bed sheets, infrequent cleaning of children's toys, failure to wash hands before meals, neglecting to wash children's hands after play, non-utilization of handwashing and bathroom soap, and caregivers who had not undergone deworming within the preceding 6 months. The outcomes of this study serve as a foundational resource for parents, healthcare professionals, and policymakers in the field of public health, facilitating the development of action programs aimed at controlling not only pinworm disease but also other diseases transmitted via the fecal-oral route.

This study, however, had inevitable limitations. The research relied on the sticky tape technique (Graham) to ascertain the presence of pinworm infection. While this technique is regarded as the gold standard for diagnosing Pinworm infections, it was administered only once to each child. Consequently, the identified prevalence of Pinworm infection may potentially underestimate the actual occurrence of the infection.

#### **4. CONCLUSION**

In 2023, within Krong Pac district, Dak Lak province, the prevalence of pinworm infection among children aged 1 to 5 years stood at 12.5% (with 95% CI: from 10.5% to 14.5%). Notably, the highest prevalence was observed among 4-year-old children, reaching 16.5%. Moreover, male children were found to be 2.6 times more susceptible to pinworm infection compared to their female counterparts. The primary risk factors associated with pinworm infection pertained to household and personal hygiene practices, including irregular mat and bed sheet cleaning, neglecting children's toy hygiene, failure to wash hands before meals, insufficient handwashing after play, lack of hand and bath soap usage, and caregivers who had not undergone deworming within the previous 6 months. Addressing these factors is paramount for reducing the prevalence of pinworm infection among children in the community.



## TỶ LỆ NHIỄM GIUN KIM VÀ CÁC YẾU TỐ LIÊN QUAN Ở TRẺ EM 1 ĐẾN 5 TUỔI TẠI HUYỆN KRÔNG PẮC, TỈNH ĐẮK LẮK NĂM 2023

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### TÓM TẮT

Giới thiệu: giun kim là một loại giun tròn phổ biến trên thế giới, hay gặp ở trẻ em với các triệu chứng như ngứa hậu môn, rối loạn tiêu hóa, tổn thương cơ thể tại nơi giun di chuyển lạc chỗ. Tại Việt Nam, nhiễm giun kim ở trẻ em xuất hiện tại hầu hết các tỉnh, thành phố với tỷ lệ nhiễm từ 10,6% đến 26,9%. Tuy nhiên, các nghiên cứu trước đây tập trung vào trẻ em đang đi học tại các trường, hầu như rất ít nghiên cứu trên trẻ em tại hộ gia đình. Phương pháp: nghiên cứu được tiến hành với hai thiết kế nghiên cứu liên tiếp nhau: nghiên cứu cắt ngang trên 1.031 trẻ từ 1 đến 5 tuổi tại hộ gia đình nhằm xác định tỷ lệ nhiễm giun kim; nghiên cứu bệnh chứng với 129 trẻ nhóm bệnh và 258 trẻ nhóm chứng nhằm xác định các yếu tố vệ sinh môi trường, vệ sinh cá nhân liên quan đến nhiễm giun kim. Sử dụng kỹ thuật Graham để xác định trẻ nhiễm giun kim và thu thập các thông tin về đặc tính dân số, yếu tố phơi nhiễm của trẻ bằng bộ câu hỏi có cấu trúc. Phép kiểm định Chi bình phương, hồi quy logistic đa biến để xác định mối liên quan giữa các yếu tố phơi nhiễm và nhiễm giun kim. Kết quả: tỷ lệ nhiễm giun kim là 12,5% (Khoảng tin cậy 10,5% - 14,5%), tỷ lệ nhiễm ở nam (16,0%) cao hơn ở nữ (7,9%); một số yếu tố nguy cơ liên quan đến nhiễm giun kim bao gồm rửa tay trước khi ăn, sau khi vui chơi, sử dụng xà phòng rửa tay, xà phòng tắm, vệ sinh đồ chơi của trẻ và tình trạng tẩy giun của người nuôi dưỡng. Kết luận: Nhiễm giun kim ở trẻ em vẫn còn là vấn đề phổ biến ở khu vực và liên quan chủ yếu đến các hành vi vệ sinh cá nhân.

*Từ khóa: tỷ lệ nhiễm giun kim, giun kim, trẻ em, các yếu tố liên quan.*

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