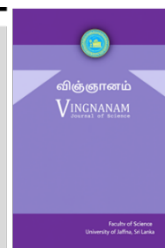




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Knowledge, Health Seeking Behaviour and Deworming Practices towards Pinworm Infestation among Primary Stakeholders of Preschools in Northern Sri Lanka: A Qualitative Approach

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ABSTRACT

Pinworm infestation, caused by *Enterobius vermicularis*, is a common public health problem among children in developing countries including Sri Lanka. This qualitative study explores the knowledge, health-seeking behavior, and deworming practices regarding pinworm infestation among primary stakeholders of preschools in Jaffna and Kilinochchi districts, in Northern Sri Lanka. Focus group interviews with parents and teachers of preschools along with key informant interviews with healthcare providers were conducted, and data were analyzed thematically. The findings revealed substantial gaps in knowledge about clinical manifestations (57%) and transmission of pinworm infestation (78%). Among the participants, 78% mistakenly attributed pinworm infestation to non-communicable causes or dietary habits rather than understanding its communicable nature. Health-seeking behaviors indicated a preference for purchasing deworming medications from private pharmacies due to convenience (35%), perceived efficacy (17%), and dissatisfaction with public health services (78%), despite financial constraints (35%). Deworming practices varied, with inconsistent treatment intervals (74%) and an absence of thorough treatments for the entire family at the same time (13%). The COVID-19 pandemic and economic challenges disrupted school-based deworming campaigns, exposing the vulnerability of public health programs. Participants expressed a need for educational initiatives, including seminars, parent meetings, and engaging awareness tools. This study highlights the urgent need for targeted educational interventions, strengthening public health delivery systems, and designing community-based approaches for sustainable control of pinworm infestation in Northern Sri Lanka.

Keywords: Pinworm, Health care providers, Northern Sri Lanka, Preschool, Deworming.

1. INTRODUCTION

Pinworm infestation, caused by the intestinal nematode *Enterobius vermicularis* (Linnaeus, 1758), is commonly reported worldwide [1-8], and approximately 60% of the cases were reported in developing countries [8] among the children with the age group of 5-14 [5,8,9]. The prevalence of pinworms is often associated with living in rural areas, larger family size and the struggle to

maintain sufficient sanitation and hygiene practices [2,3].

Pinworm infestation is commonly observed in children with the clinical manifestations of pruritus ani at night, restlessness at night, tooth grinding, and younger children sleeping face down [10-12]. There are reports of pinworm infestations from various parts of Sri Lanka [13-16] including northern Sri Lanka [17].

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A nationwide survey carried out by the Ministry of Health in 2017 reveals that pinworm infestation remains a public health problem in Sri Lanka despite most Soil Transmitted Helminths (STH) being under control in the country ^[17].

Furthermore, the same survey pointed out that the Northern Province of Sri Lanka had the highest prevalence of pinworm infestation (37.7 % [95% CI, 29.6 - 46.7]) among the nine provinces ^[17], whereas the prevalence of any STH infestation in the province was comparably low (0.61% [95% CI, 0.16 - 2.33]) ^[17].

The above scenario reveals controlling pinworm infestation has unique challenges compared to controlling STH in Northern Sri Lanka.

Soil-transmitted helminths, such as roundworms, whipworms, and hookworms, require soil to become infectious. As STHs rely on environmental factors such as soil temperature, pH, and moisture to develop their infective forms, the possibilities for interrupting their life cycles through environmental control measures can create more opportunities to control STHs than pinworms ^[18,19].

Pinworms are transmitted directly from person to person, usually through the faeco-oral route without the involvement of the soil. This direct transmission mechanism makes it particularly difficult to control, as it can occur simply by the presence of eggs on contaminated surfaces or through direct contact with an infected person. Furthermore, pinworm eggs can remain viable for several weeks, thereby contaminating homes, schools, and other environments and increasing the risk of reinfection. Environmental surveys have documented pinworm egg contamination on various surfaces, including books, toys, door handles, desks, and clothing in educational settings ^[20].

Therefore, effective control of pinworms includes rigorous personal hygiene practices, such as frequent handwashing, especially after using the toilet and before meals with soap ^[22]; keeping their nails short and clean and preventing nail biting, which can prevent pinworm eggs from lodging under the nails and facilitating transmission, if scratched near the anal area ^[8,23];

regular cleaning of living areas; and washing clothes and bedding in hot water ^[23,24].

Moreover, simultaneous treatment of all household members is crucial for preventing and controlling pinworm infestation ^[5,25,26]. Despite effective treatments, recurrence is common due to the environmental persistence of eggs and autoinfection^[5]. Therefore, anthelmintic treatments are effective if repeated after two weeks to ensure that any newly hatched worms are eliminated ^[24,27].

Access to anthelmintic treatment through health services is essential, because the non-consumption of deworming medication significantly increases the risk of infestation ^[22].

Despite the availability of effective treatments, the prevention and control of pinworm infestations continue to be difficult due to factors such as reinfection, incomplete treatment, and easy spread ^[28].

Hence, awareness of the above mentioned contributory factors and the practice of knowledge in real settings by stakeholders in controlling pinworm infestation is crucial.

With this background, this study aims to explore the knowledge, health-seeking behaviour, and practice of preventive measures regarding pinworm infestation among the primary stakeholders of preschools in Jaffna and Kilinochchi Districts.

2. MATERIALS AND METHODOLOGY

This qualitative study was conducted, from July to December 2022, in two districts (Jaffna and Kilinochchi) among the five districts in Northern Sri Lanka.

Purposive sampling was employed to ensure the inclusion of diverse perspectives, recruiting key stakeholders i.e. involved in preschool child care and health promotion, which are crucial for a comprehensive understanding of knowledge and related issues regarding pinworms. Accordingly, 26 participant took part in this study i.e. 12 mothers of preschool children; 11 preschool teachers; one Medical Officer attached to the Teaching Hospital; Jaffna; one Public Health Inspector (PHI) and one Public Health Midwife (PHM).

Altogether eight interviews were conducted by the authors under the supervision of field experts, after the training sessions, in the Jaffna and Kilinochchi districts among those participants. Data were collected through Focus Group Interviews with parents and Key Informant Interviews with Medical Officer, PHI, PHM and preschool teachers.

To facilitate a deeper exploration, the interviews commenced with basic demographic questions. Participants were subsequently queried on their knowledge, practices, and existing preventive measures among healthcare providers and service recipients.

Eight interviews were conducted in both districts until data saturation was reached. The duration of the interviews varied, ranging from 35 to 85 min. Interviews were conducted in the native (Tamil) language and covered the aspects such as clinical presentation and transmission of pinworms; health seeking behaviours of parents; practice of current pinworm control measures and the perception on existing control strategies.

Interviews were conducted in private settings to prioritize the comfort and privacy of the interviewees, with an emphasis on informed consent, confidentiality, and the option to withdraw from the study at any time.

These sessions were recorded with the participants' consent, and research assistants took written notes to ensure and enhance the data quality. The recorded audio was transcribed after multiple listenings and then translated into English. The transcribed and translated data were coded and categorized into themes and analyzed manually using Microsoft Excel (Microsoft Corp., Redmond, WA, USA).

Ethical Considerations

Ethical clearance was obtained from the Ethical Review Committee at the Teaching Hospital Jaffna, Sri Lanka (Reg. No: S01/06/2022).

3. RESULTS AND DISCUSSION

Altogether 12 mothers of preschool children, 11 preschool teachers, one Medical Officer attached to the Teaching Hospital, Jaffna, one Public

Health Inspector (PHI) and one Public Health Midwife (PHM) participated in this study.

Upon analyzing the translated and transcribed data, four main themes were identified: (I) awareness and knowledge regarding the pinworm infestation; (II) health seeking behaviour; (III) practice of pinworm control measures; and (IV) perception of existing control strategies.

Awareness and Knowledge about pinworm infestation

Among the respondents, 43% had the knowledge of the signs and symptoms, particularly regarding the pinworm infestation. However, 22% of the participants mentioned the signs and symptoms of pinworm infestation such as the anal itching, loss of appetite, stomachache, and nausea:

When our kids itch the anal area saying the area is itchy, we assume it's pinworm infection (parent 2, FGD). My kids said that they have stomach aches (parent 6, FGD). Children have loss of appetite, drowsy eyes, some children release the pinworm via vomit and stool (preschool teacher 7, FGD).

Among the participants, 78% mentioned several transmission routes, nonspecific to pinworm transmission, including defecation in unhygienic locations, consumption of contaminated food, and play in unsanitary environments. Additionally, 70% of the participants noted that pinworm infestation is attributed to unhygienic practices, such as children becoming infected while playing on muddy ground and defecating in unclean areas. However, some participants perceived it as a non-communicable disease, whereas others emphasized its transmission through contaminated environments and poor hygiene practices. Divergent views on transmission included direct person-to-person contact and transmission via flies:

I think mostly defecating in dirty/unhygienic places is the main way of getting pinworm disease (preschool teacher 6, FGD). The disease spread through certain dietary habits/practices, polluted living environment, and playing in muddy grounds" (parent 5, FGD). Eating more sweets can also cause pinworm infection (parent 4,

FGD). *Yes, it is communicable. When defecating and not washing hands with soap after defecation and touching objects which other people can contact* (parent 2, FGD).

Knowledge regarding the prevention and control measures of pinworm infestation among the recipients was reasonably acceptable:

We help the children wash their hands with soap before meals. We also inform the parents about their children having pinworm infections by observing the kids' behaviour. Such as, the child being tired/dull, the child's eyes don't look normal (preschool teacher 6, FGD).

Healthcare professionals emphasized the significance of accurate diagnosis and appropriate treatment for pinworm infestation. They highlighted the importance of advising patients on the correct use of medications and delivering health education on worm infestations.

Health-Seeking behavior regarding pinworm infestation

Participants frequently acquired deworming tablets from the Ministry of Health (MOH) and local pharmacies. Among the participants, 78% expressed dissatisfaction with the deworming services provided by public hospitals and opted to purchase medications from local pharmacies (65%). Participants expressed the preference for purchasing medication from local pharmacies due to the convenience (35%), travel costs (13%), and perceived effectiveness (17%).

People get drugs from the MOH office and pharmacy (parent 6, FGD). *Mostly I buy the tablets in the pharmacy* (parent 2, FGD).

We got deworming tablets from the hospital in the Well Baby clinic till the child was 5 years old. After that, we had to consume the tablet outside (parent 1, FGD). *In well baby clinic at MOH, they provide tablets for everyone in the family* (PHM 2, KII). *We aren't satisfied with the deworming provided in the public hospital but the ones we buy in the pharmacy are good* (parent 3, FGD).

Thirty-five percentage of the participants identified financial constraints as a burden to accessing healthcare services, which subsequently influenced their decision-making regarding the selection between public hospitals

and pharmacies for obtaining deworming medication:

Tablet's price is 50 LKR to 100 LKR per tablet. One tablet per child and for every person in the family (parent 2 & 8, FGD).

Among the parents, 17% mentioned the long time spent at the public hospital made them choose private pharmacies despite the financial constraints:

I get medicines from government hospitals but mostly private dispensaries because we need to stand in the queue in the hospital (parent 4, FGD). *Buying drugs in a pharmacy is easier, it will take time in the hospital to get medicine* (parent 8, FGD).

Stigma and misconceptions associated with pinworm infestation have been identified as obstacles to health-seeking behavior, affecting individuals' willingness to discuss and address the issue openly:

Hospital staff asked us not to bath for 3 days and not to take oily foods (parent 7, FGD).

Deworming practice to prevent and control pinworm infestation

Participants engaged in a discussion regarding deworming and its implications for health. Thirteen percent of the parents mentioned the entire family receiving the treatment at the same time:

Everyone in our family takes the tablet together (parent 9, FGD).

Opinions varied with respect to the optimal interval for administering deworming tablets (74%), with suggestions ranging from every three months to every six months:

Earlier, it was once every 6 months. But now it's once every three months, particularly for the children. Because they eat so many sweets (parent 4, FGD). *In three days after consuming the tablet, we feel the difference. If not, we can get the tablet again* (parent 8, FGD). *We recommend continuing to take medicine every three months* (preschool teacher 3, FGD). *In the hospital, the health workers advise us to take the tablet once every 3 months but in pharmacies it's different* (parent 1, FGD).

Further, some parents have the tendency to practice traditional ways of deworming using herbs:

Neem juice is also a traditional way of treating which we still practice. However, our kids don't like the neem juice and bitter gourd juice/curry due to the bitterness. But during the COVID endemic period, we fed them neem juice (parent 3, FGD).

Perception on existing pinworm control strategy

Participants engaged in a comparative analysis of the sources from which they procured deworming medication, specifically evaluating public hospitals and pharmacies. Their choices were influenced by factors such as convenience, waiting time, and perceived effectiveness:

They can get it from public hospitals and from pharmacies as well (MO 1, KII). They also buy it at the pharmacy because one tablet is easy for them (PHM 1, KII). We aren't satisfied with the deworming provided in the public hospital, but the ones we buy in the pharmacy are good (parent 5, FGD). We get medicines from government hospitals but mostly private dispensaries because we need to stand in the queue in the hospital (parent 4, FGD).

The challenges inherent in delivering preventive services have been highlighted, including economic constraints, disruptions resulting from the COVID-19 pandemic:

In schools, deworming tablets were distributed till the year 2019, and it's now not happening due to the COVID pandemic and economic crisis (PHI 2, KII).

Perspectives on traditional deworming methods and considerations related to program implementation were also expressed:

Healthy diet practices or giving selective vegetables to the kids. Like bitter gourd which is a very effective way of treating pinworm infection (parent 1, FGD). Neem juice is also a traditional way of treating which we still practice. However, our kids don't like the neem juice and bitter gourd juice/curry due to the bitterness. But during the COVID endemic period, we emphasize feeding them neem juice (parent 6, FGD).

Moreover, recommendations were proposed for implementing educational seminars and workshops aimed at increasing awareness of pinworm infestation. These initiatives should prioritize parent meetings and engage children through animated videos:

No seminars were conducted by the health sector. But such seminars or workshops are much needed (preschool teacher 4; FGD PHM 2, KII). You can utilize the parents meeting to talk to the parents about not only the pinworm infection but also cavity problems connecting to their habits and living environment (preschool teacher 1, FGD). Animated videos and attractive notices can help children know about the diseases too (preschool teacher 5, FGD).

The findings of this qualitative study reveal substantial gaps in knowledge, health-seeking behaviours, and preventive practices concerning pinworm infestation among the primary stakeholders involved in preschools in the Jaffna and Kilinochchi districts. Despite the well-documented high prevalence of pinworm infestation in Northern Sri Lanka, awareness of the clinical manifestations and specific transmission pathways remains notably limited among both parents and preschool teachers. A similar finding was revealed in studies conducted in Sri Lanka where lack of education or awareness was found to be significant in the prevalence of pinworm infestation [13,14]. This lack of accurate knowledge such as the direct person-to-person transmission of pinworms and the environmental persistence of their eggs, factors that complicate control efforts more than those for other soil-transmitted helminths, is consistent with previous studies [8,17]. Hence, the lack of awareness may result in inadequate hygienic practices and an elevated risk of disease transmission among children in preschool settings.

Parental knowledge and awareness, particularly during nighttime observations, can play a crucial role in identifying signs and symptoms of pinworm infestation [9,10]. This awareness enables parents, especially mothers, to seek assistance from health authorities for anthelmintic

treatment. Subsequently, this involvement not only aids in controlling pinworm infestation within the family but also helps prevent its further spread within the community.

In addition to lack of knowledge, many participants exhibited misconceptions, such as attributing the infection to non-communicable causes or dietary habits, which could significantly hinder effective prevention and control measures. Kubiak et al reported that ineffective hygienic practices, overcrowded living conditions, poor sanitation are the more likely risk factors for pinworm infestation rather than dietary habits [23]. Such misconceptions not only hinder timely recognition and treatment, but also foster stigmatization and misinformation within communities, thereby perpetuating the cycle of infection and reinfection. The persistence of these knowledge gaps underscores the critical need for targeted educational interventions [23].

The health-seeking behaviours identified in this study indicate a preference for procuring deworming medications from private pharmacies rather than from public health services. A recent study carried out in India also reveals that more than 70% purchased private drugs [29]. This preference is driven by considerations such as convenience, perceived efficacy, and dissatisfaction with public hospital services. Though the economic factors, the cost of medication favours the public hospitals, the indirect costs such as travel and waiting time at government facilities, made them to purchase the deworming medication from the private pharmacies. A study carried out in India indicates that the selection of pharmacies over public hospitals for purchasing medication was influenced by the factors such as convenience and better drug stocks and higher satisfaction [30]. These findings underscore the urgent need to strengthen public health delivery systems and rebuild trust in government-provided deworming programs to enhance access and adherence among affected populations. The tendency to bypass public health facilities in favour of private pharmacies may also reflect broader systemic issues, such as inadequate communication,

limited outreach, and resource constraints within the public sector, which collectively diminish the perceived value of government services. Addressing these systemic barriers will require comprehensive strategies that improve service quality, reduce waiting times, and enhance community engagement to restore confidence in public health interventions.

Deworming practices varied widely among participants, with inconsistent treatment intervals and a lack of comprehensive family-wide treatment, despite strong evidence supporting the necessity of simultaneous treatment of all household members [8,25,26] and repeating after two weeks [24,27] are crucial to prevent the reinfection.

The use of traditional remedies, such as neem juice and bitter gourd preparations, reflects deep-rooted cultural influences on health practices that must be acknowledged and integrated into intervention strategies.

The persistence of reinfection and recurrence following treatment highlights the indispensable role of environmental hygiene and behavioural interventions alongside pharmacological approaches to achieve sustainable control. This includes regular handwashing with soap [21], maintaining short and clean nails to prevent egg lodging [8,22], thorough cleaning of living spaces, and laundering clothes and bedding in hot water to eliminate viable eggs from the environment [23,24]. Such integrated measures are essential to break the cycle of transmission and reduce the burden of disease. Emphasizing these combined strategies in health promotion campaigns can enhance community acceptance and adherence, thereby improving overall outcomes.

Participants' perceptions of existing control strategies revealed significant disruptions caused by the COVID-19 pandemic and prevailing economic challenges, which led a reduction in the school-based deworming campaigns. This interruption exposes the vulnerability of public health programs to external shocks and emphasizes the importance of designing resilient, community-based approaches for ongoing control efforts. The interruption of these campaigns has likely contributed to increased

transmission rates and reduced awareness, further complicating control efforts.

Additionally, stakeholders expressed a clear demand for enhanced educational initiatives, including seminars, parent meetings, and engaging, child-friendly awareness tools such as animated videos. These educational strategies have the potential to correct misconceptions, promote hygienic behaviours, and improve compliance with treatment regimens. Further, strengthening community participation and ownership of these programs can enhance sustainability and responsiveness in prevent and control pinworm infestation within the community.

The study has few limitations. The study mainly focuses on the perspective of preschool teachers and parents and does not consider the role of healthcare providers or public health officials in preventing and treating pinworm infestation.

4. CONCLUSION

Knowledge, health seeking behaviour, deworming practices and preventive activities of pinworm infestation were low among parents and preschool teachers. Therefore, intense health educational programs among the direct stakeholders, particularly for the parents, will help to prevent and control pinworm infestation in the community. Further, an in-depth study to determine the prevalence and severity of pinworm infection among preschool children in Northern Province is recommended.

Conflict of Interest

All authors have none to declare.

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Author Contribution

BK, SK and AM conceptualised the study. TJ, MT, MC and BG involved in acquisition of data. LL did thematic analysis. LL, SK, BK and AM wrote the manuscript.

All authors read and approved the final manuscript.

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