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Review Article

A REVIEW ON DIARRHOEA CAUSING HYMENOLEPIS NANA-DWARF TAPEWORM

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ABSTRACT

Hymenolepis nana, the 'dwarf tapeworm,' is the smallest tapeworm found in the intestines of broad range of dogs, rats and humans. It is frequently in children than in adults. Although, the parasite has a wide distribution particularly more prevalent in warm areas. It exists in many parts of the world in Egypt, Sudan Portugal, Spain, Sicily, India, Japan, South America, Cuba and parts of Eastern Europe. The transmission of *H. nana* is mainly via anus to mouth and owing to this; the infection is very common in children. The incidence of infection in humans ranges from less 1% to 25 %. Infection consists of a few worms but occasionally large numbers of worms are present in an individual. Diagnosis is usually based on finding eggs in stool specimens. The infection can be prevented by observing strict personal hygiene and good sanitation, killing of rats and mice and by treatment of infected persons with a suitable taenicide such as niclosamide.

KEYWORDS: Hymenolepis nana, dwarf tapeworm, Diarrhoea, intestinal parasite.

INTRODUCTION

Dwarf tapeworm (*Hymenolepis nana*, also known as *Vampirolepis nana*, *Hymenolepis fraterna*, and *Taenia nana*) is found throughout the world and one of the most common Cestodes parasites of the phylum Platy helminthes that infects a wide range of domesticated and wild animals humans and especially children and in temperate zones children and institutionalized people are infected more often. H. nana infection can cause emaciation and diarrhea and can even be life-threatening. It is a zoonotic parasite, and its principal definitive hosts are rodents[1, 2]. It is also known as the dwarf tapeworm due to its particularly small size (adults are only 15–40 mm long).

History

In 1921, Saeki demonstrated direct cycle of transmission of *H. nana* in humans; transmission without an intermediate host[3-4]. In addition to the direct cycle, Nicholl and Minchin demonstrated that fleas can serve as intermediate hosts between humans[5].

Geographic Distribution and Prevalence

H. nana is the most common cestode in humans with infection prevalence highest among children encountered worldwide and in warm arid climates with poor sanitation facilities[6-7]. The prevalence of *H. nana* in isolated communities in northwest Australia is extremely high, 55%. The transmission is due mostly from human to human contact and auto-infection[8]. In Bat Dambang, Cambodia, middle school students were found to have a 2.4 % prevalence[9].

In Pakistan prevalence of *H. nana* was 1.81%[10]. Another study reported 27.25% in Mansehra, Pakistan[11]. *H. nana* (3.0 %) in the city of Abha, South Western, Saudi Arabia[12].

A study reported in Turkey Shantytown schools compared with Apartment schools showed a higher prevalence in the Shantytowns, 13.6% in males and 15.0% in females, as opposed to Apartment schools which still had a significant prevalence of 2.2% in males and 8.4% in females. Children were presenting with anemia, intestinal worms, and stunted growth raising public health concerns[13].

In 2006, a study conducted in rural Mexico found that 25% of the children ages 6-10 in twelve schools were infected with *H. nana*. The study indicates that socioeconomic factors and lack of parent education are tough influences on the high prevalence rate[14].

Zimbabwe children in both small towns and high-density suburbs suffer from *H. nana*. Infections have a tendency to be more common in younger children who live in urban areas and in older children who live in rural locations. The study reported an overall prevalence rate of 24% in urban areas and an18% prevalence in rural towns[15].

Morphology:

H. nana worms are dwarf tapeworm and segmented with skinny necks. They vary in length from approximately 15 to 40 mm in length and 1 mm wide[16-17]. This tapeworm is transparent, and has a long slender neck with segments wider than they are long. The genital pores are unilateral, or on the side of the segment. Each segment contains a single proglottid, which contains a single set of reproductive organs. On the scolex, a retractable rostellum with 20 to 30 hooks can be found[18]. The scolex also has four suckers[6-19].

The cysticercoid has a tail, which is made of longitudinal fibers and is spade shaped with the rest of the worm still inside the cyst[18]. The eggs are round or slightly oval at about 40-60 micrometers with 4-8 polar filaments spread out between the inner and outer membranes[20].

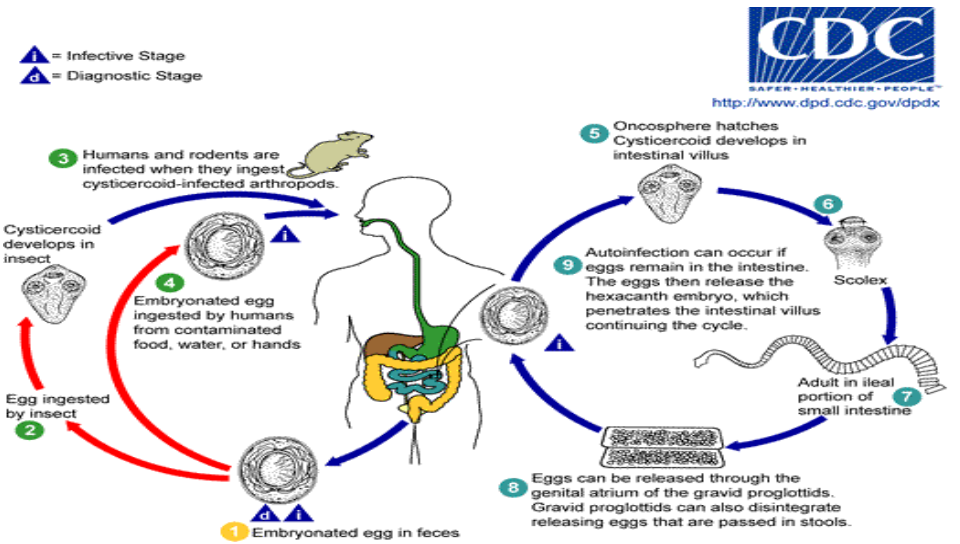
Development:

A gravid proglottid contains fertilized eggs, which are sometimes expelled with the feces[21]. When the eggs are ingested by humans, rats or mice, the oncosphere begin to crawl actively inside their shells, and escapes in the lumen of intestine[22]. Though, usually, the egg settles in the microvillus of the small intestine, hatch, and the larvae can develop to sexual maturity without ever leaving the host[23-24]. This helminthes can go through its life cycle with only one host or can also go through the normal two-host cycle[2, 25].

Life cycle:

H. nana is the only tapeworm that can be transmitted directly from person to person and differs from almost all other tapeworms in being able to complete its entire life cycle in a single host[10].

Eggs of *Hymenolepis nana* are at once infective when passed with the stool and cannot survive more than 10 days in the external environment. When eggs are ingested by an arthropod intermediate host, they develop into cysticercoids, which can infect humans or rodents upon ingestion and develop into adults in the small intestine. When eggs are ingested (in contaminated food or water or from hands contaminated with feces), the oncosphere contained in the eggs are released. The oncosphere (hexacanth larvae) penetrate the intestinal villus and develop into cysticercoid larvae. Upon rupture of the villus, the cysticercoids return to the intestinal lumen, evaginate their scoleces, attach to the intestinal mucosa and develop into adults that reside in the ileal portion of the small intestine producing gravid proglottids. Eggs are passed in the stool when released from proglottids through its genital atrium or when proglottids disintegrate in the small intestine. An alternate mode of infection consists of internal autoinfection, where the eggs release their hexacanth embryo, which penetrates the villus continuing the infective cycle without passage through the external environment. The life span of adult worms is 4 to 6 weeks, but internal autoinfection allows the infection to persist for years[2, 26-28].



Behavior:

Hymenolepis nana does not have a digestive system and each body segment has its individual reproductive structures[2].

Communication and Perception:

Hymenolepis nana has sensory organs in the scolex, which are attached to longitudinal nerves extending down the body. The nerves are attached to organs and the Cestodes can detect tactile stimulation[29].

Pathogenicity:

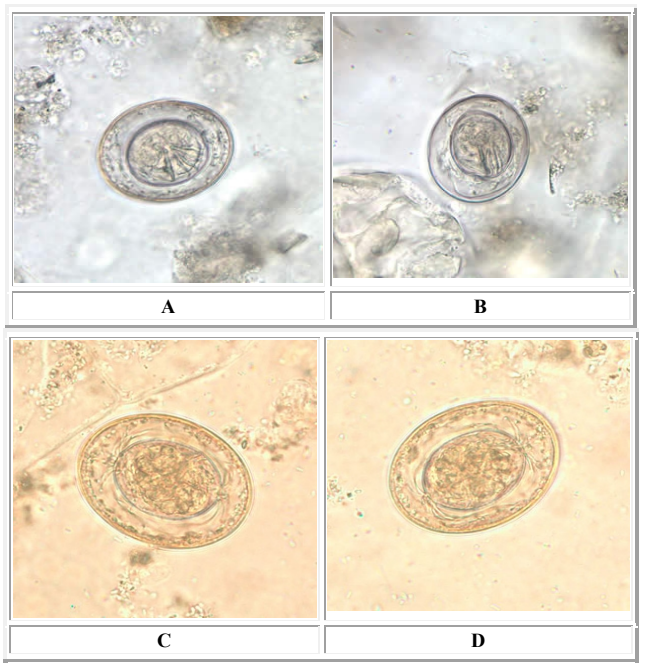
H. nana eggs are passed throughout the stool of human hosts. These eggs are then consumed by rats or humans through infected food or water. A study reported that in 2000 nine pet stores surveyed in Connecticut U.S.A., 75% sold rats, mice or hamsters infected with *H. Nana*[6]. Humans or rodents can be the reservoir of H. nana. Hymenolepis has no vectors.

Laboratory Diagnosis:

The diagnosis of *H. nana* depends on the appearance of eggs in stool specimens. Concentration techniques and examinations increase the probability of detecting light infections[26, 30].

Microscopic examination:

H. nana eggs are frequently spherical or ovoid with a thin hyaline shell and measure 30-47 µm in diameter. The oncosphere with its 3 pairs of hooklets lies in the center of the egg and is separated from the outer shell by sizeable space. The oncosphere has an internal membrane with polar thickenings from which arise 4 to 8 filaments extending into the space between it and the colorless hyaline shell[31].



A-B: Eggs of *Hymenolepis nana*.

These eggs are oval and smaller, with a size range of 30 to 50 µm. On the inner membrane are two poles, from which 4-8 polar filaments spread out between the two membranes. The oncosphere has six hooks.

Macroscopic (gross) observations:

The adult *H. nana* tapeworm ranges from 7-50 mm in length with up to 200 proglottids, though proglottids are rarely found in feces samples. The proglottids are almost 4 times wider than they are long. The scolex is knob like in shape, has a rostellum with hooklets and 4 suckers.

E

E: Three adult *Hymenolepis nana* tapeworms. Each tapeworm (length: 15 to 40 mm) has a small, rounded scolex at the anterior end, and proglottids can be distinguished at the posterior, wider end. Image contributed by the Georgia Division of Public Health.

Clinical Features:

It is not clear that *H. nana* necessarily have any symptoms. However, in one study of 25 patients conducted in Peru, successful treatment of the infection made no significant difference to symptoms[32]. Some authorities report that heavily infected cases are more likely to be symptomatic[33-34]. *Hymenolepis nana* infection is most often asymptomatic. Heavy infections with *H. nana* can cause weakness, headaches, anorexia, irritability, abdominal pain, itching around the anus and diarrhea. Hymenolepiasis is usually asymptomatic in adults. But prolonged infection or multiple tapeworms especially in children can cause more severe symptoms. In symptomatic patients, the symptoms were mild and non-specific such as pruritus ani, abdominal pain, diarrhea, anorexia, headache, and dizziness[35]. The method of infection and the of immunity are interconnected[36]. When a cysticercoid is ingested, is little development of immunity, and during autoinfection the number of worms may become large. In contrast, eggs are ingested; immunity usually develops rapidly[23, 37].

Treatment:

Praziquantel or niclosamide are the drugs most frequently used to treat *H. nana* infection[37].

H. nana cysticercoids are not as susceptible Praziquantel in a single oral dose of 25 mg/kg body weight was effective and well tolerated in *H. nana* infected individuals[35]. Niclosamide or Albendazole has also been used[32, 39-40].

CONCLUSION

To prevent getting infected good hygienic condition must be applied, wash, peel or cook all fruits and vegetables. Wash hands with water and soap after using the toilet and before preparing food or eating. Quit the habit of putting fingers in your nose and mouth. The microscopic parasite eggs are sometimes found under fingernails and can easily be ingested. Public health and sanitation programs must be considered.

REFERENCES

1. Li B, Zhao B, Yang GY, Wang Q, Niu LL, Deng JB, Gu XB, Wang SX. Mebendazole in the treatment of Hymenolepis nana infections in the captive ring-tailed lemur (Lemur catta), China. Parasitol Res. 2012;111 (2) :935 – 7
2. Roberts, L., J. Janovy Jr.. 2000. Foundations of Parasitology, Sixth Edition. MA: Mcgraw-Hill Higher Education.
3. Baron S., (1996). Medical Microbiology. (4th edition). The University of Texas Medical Branch at Galveston.
4. Blanton R. Adult tapeworm infections. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF, eds. Nelson Textbook of Pediatrics. 18th Ed. Philadelphia, Pa: Saunders Elsevier; 2007: chap 299
5. Marty AM and Neafie RC *Hymenolepiasis and Miscellaneous Cyclophyllidiases* pages 197- 214 *in* Meyers WM, Neafie RC, Marty AM, Wear DJ. (Eds) Pathology of Infectious Diseases Volume I Helminthiases. Armed Forces Institute of Pathology, Washington DC. 2000
6. Schantz, Peter M. "Tapeworms (Cestodiasis)." Gastroenterology Clinics of North America. 2006; 25 (3):637-653
7. World Health Organization (1995). WHO model prescribing information: drugs used in parasitic diseases (2nd edition). Published by World Health Organization
8. Macnish, Marion. (2001). "Characterization of Community-Derived Hymenolepis in Australia." Murdoch University Medical Science Thesis.
9. Seung Kyu Park, Dong-Heui Kim, Young-Kun Deung, Hun-Joo Kim, Eun-Ju Yang, Soo-Jung Lim, Yong-Suk Ryang, Dan Jin, and Kyu-Jae Lee. (2004). "Status of intestinal parasite infections among children in Bat Dambang, Cambodia." The Korean Journal of Parasitology. 2004; 42 (4): 201-203
10. Tasawar Z , Gul S , Bhutta MA and Arif M. Prevalence of *Hymenolepis nana* in Human Beings in and Around Multan. Pakistan. Pak J Life Soc Sci. 2004; 2(1): 62-64
11. Afzal, A. Prevalence of intestinal parasites in eight school children of Mansehra (Pakistan). M. Sc. Thesis. Dept. Zool. Univ. Peshawar, Pakistan. 1981
12. Omar, M.S. Abuzeid, H.A.H. and Mahfouz, A.A.R.Intestinal parasitic infection in school children of Anha (Asir). Acta. Trop. 1991. 48: 195-202
13. Ulukanligil, M. Seyrek, A. "Anthropometric status, anaemia and intestinal helminthic infections in shantytown and apartment schoolchildren in the Sanliurfa province of Turkey. European Journal of Clinical Nutrition. 2004; 58 (7) : 1056-1061.
14. Luis Quihui, Mauro E Valencia, David WT Crompton, Stephen Phillips, Paul Hagan, Gloria Morales, Silvia P Díaz-Camacho. "Role of the employment status and education of mothers in the prevalence of intestinal parasitic infections in Mexican rural schoolchildren." BMC Public Health. 2006; 6; 225
15. Peter R. Mason, Barbara A. Patterson. "Epidemiology of Hymenolepis nana Infections in Primary School Children in Urban and Rural Communities in Zimbabwe." The Journal of Parasitology. 1994; 80 (2): 245-250.
16. Lapage, G. 1951. Parasitic Animals. Great Britain: The University Press.
17. Richard FO Jr. Diphyllobothrium, dipylidium, and hymenolepsis species. In: Long SS, Pickering LK, Prober CG. Principles and Practice of Pediatric Infectious Diseases. 3rd ed. Philadelphia, Pa: Churchill Livingstone Elsevier; 2008: chap: 279
18. Roberts, L., J. Janovy Jr.. 2000. Foundations of Parasitology, Sixth Edition. MA: Mcgraw-Hill Higher Education.
19. Gerald D. Schmidt, John Janovy, Jr and Larry S. Roberts (2009). Foundations of Parasitology (8th ed). McGraw-Hil.
20. Ghaffar, A. 2001. "Cestodes" (On-line). Accessed October 14, 2004
21. Cameron, T. 1956. Parasites and Parsitism. NY: John Wiley and Sons, Inc.
22. Zeibig, E.A. Clinical Parasitology: A practical approach. 1st Ed. W.B. Saunders Company, Philadelphia. 1997. 1-189
23. Marquardt, W.C. and Demaree, R.S. Parasitology.McMillan publishing Company, New York Collier McMillan Publishers, London. 1985 : 494-496
24. Olsen, O. 1974. Animal Parasites, Third Edition. MD: University Park Press.
25. Kumazawa H, Fairweather I. Growth of single proglottides during early adult development of Hymenolepis nana. Parasitology. 1989 Aug;99 Pt 1:115-25
26. Ash LR, Orihel TC. 2003. pp. 2031-2046. (p. 243) Intestinal Helminths. In PR Murray PR et al. (eds.) Manual of Clinical *Microbiology*. 8th ed. Vol. 2. ASM Press, Washington, DC.
27. DPDx CDC Laboratory Identification of Parasites of Public Health Concern.
28. Fan PC. Infectivity and development of the human strain of Hymenolepis nana in ICR mice. Southeast Asian J Trop Med Public Health. 2005 Jan;36(1):97-102.
29. Brusca, R., G. Brusca. 2003. Invertebrates. Sunderland, Massachusetts: Sinauer Associates, Inc.
30. Heelan JS. 2004. pp. 165-166. *Cases in Human Parasitology.* ASM Press, Washington, DC

31. Mahmoud MS, A.H. El Namaky, O.M. Kandil, T.N. Allam, A.A. Hasan and H.M. Ashry. Advanced Approach in Differentiation Study in Hymenolepis nana and H. Diminuta by Scanning Electron Microscopy. Acta Parasitologica Globalis.2011; 2 (2): 34-39, 2011
32. Chero JC, Saito M, Bustos JA. "*Hymenolepis nana* infection: symptoms and response to nitazoxanide in field conditions". Trans R Soc Trop Med Hyg. 2007; 101 (2): 203–5
33. Schantz PM. "Tapeworms (cestodiasis)". *Gastroenterol. Clin.* North Am. 1996; 25 (3): 637–53.
34. Chitchang S, Plamjinda T, Yodmani B, Radomyos P. "Relationship between severity of the symptom and the number of Hymenolepis nana after treatment". J Med Assoc Thai. 1985; 68 (8): 423–26.
35. Sirivichayakul C, Radomyos P, Praevanit R, Pojjaroen – Anant C, Wisetsing P. Hymenolepis nana infection in Thai children. J Med Assoc Thai. 2000 ; 83 (9) : 1035 – 8
36. Menan, E.I.H., Nebavi, N.F.G., Adjetey, T.A.K.,Assavo, N.N., KikiBarro P.C. and Kone. M. Profile of intestinal helminthiasis in children of school age in the city of Abidjan. Bull. De. La. Soc. De. Pathol. Exolique, 1997. 90: 51-54
37. Juckett, G. Common Intestinal helminths. American Family Phys., 1995. 52: 2039-2048.
38. King CH. 2005. Cestodes (Tapeworms) pp. 3285-3293. *In* GL Mandell, JE Bennett, R Dolin (eds.) *Principles and Practice of Infectious Diseases*. 6th ed. Elsevier Academic Press. London.
39. Ortiz JJ, Favennec L, Chegne NL, Gargala G. "Comparative clinical studis of nitazoxanide, albendazole and praziquantel in the treatment of ascariasis, trichuriasis, and hymenolepiasis in children from Peru". Trans R Soc Trop med Hyg. 2002; 96 (2): 193–96.
40. Romero Cabello R, Guerrero LR, Muñóz García MR, Geyne Cruz A. "Nitazoxanide for the treatment of intestinal protozoan and helminthic infections in Mexico". Trans. R. Soc. Trop. Med. Hyg. 1997; 91 (6): 701–3

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