Bio-Science Research Bulletin
Volume 40, Number 2
July-December 2024: P.60-63
Review Article

Print version ISSN 0970 0889
Online version ISSN 2320 3161

http://www.bpasjournals.com

Nematodes Effects on Human Health

[1]Supriya Kumari* and [2]Dr. Vijay Kumar

Author's Affiliation:
[1]Research Scholar, PG. Dept. of Zoology R.N College (BRABU Muzaffarpur) Hajipur 844101, Bihar, India.
[2]Associate Professor, PG. Dept. of Zoology R.N College Hajipur (BRABU Muzaffarpur) Hajipur 844101, Bihar, India.

***Corresponding Author:**
Supriya Kumari
Research Scholar, PG. Dept. of Zoology R.N College (BRABU Muzaffarpur) Hajipur 844101, Bihar, India.
E-mail: sup698607@gmail.com

ABSTRACT
Nematodes, or roundworms, encompass a diverse group of organisms with significant implications for human health globally. This review explores the impact of nematodes on human health, focusing on parasitic infections and potential therapeutic applications. Parasitic nematodes infect over a billion people worldwide, causing diseases ranging from intestinal discomfort to severe systemic manifestations. Key parasitic nematodes include Ascaris lumbricoides, Necator americanus, Ancylostoma duodenale, Trichuris trichiura, Wuchereria bancrofti, and Onchocerca volvulus, each with distinct pathogenic mechanisms and clinical outcomes. Intestinal nematodes such as Ascaris and hookworms contribute to malnutrition, anemia, and impaired childhood development, particularly in regions with inadequate sanitation and hygiene. Tissue-invasive nematodes like Wuchereria bancrofti and Onchocerca volvulus cause lymphatic filariasis and onchocerciasis, leading to debilitating conditions such as lymphedema and blindness. The socio-economic impact of nematode infections is profound, encompassing healthcare costs, loss of productivity, and educational disruption. Control strategies primarily involve mass drug administration (MDA) of anthelmintic drugs, sanitation improvements, and vector control to mitigate transmission. However, emerging drug resistance poses challenges to effective disease management, necessitating innovative approaches and integrated interventions. Beyond their pathogenic role, nematodes offer potential therapeutic benefits. Research into their immunomodulatory effects has uncovered promising avenues for treating autoimmune diseases and allergies. Bioactive molecules produced by nematodes, including antibiotics and anti-inflammatories, hold pharmaceutical potential. Model nematodes like Caenorhabditis elegans provide insights into genetic pathways, development, and neurobiology, facilitating biomedical research and drug discovery. This abstract summarizes the multifaceted impact of nematodes on human health, emphasizing the need for comprehensive strategies to combat parasitic infections while exploring their therapeutic applications.

KEYWORDS: *Nematodes, Roundworms, Parasitic Infections, Public Health, Anthelmintic Drugs, Immunomodulation, Therapeutic Potential.*

Received on 20.05.2024, Revised on 08.07.2024, Accepted on 26.09.2024

How to cite this article: Kumari S. and Kumar V. (2024). Nematodes Effects on Human Health. *Bio-Science Research Bulletin*, 40(2), 60-63.

INTRODCUTION

Studying the effects of nematodes on human health requires a comprehensive exploration of their diverse roles, from parasitic infections causing significant morbidity to potential therapeutic applications and ecological interactions. Here's a detailed analysis:

Introduction to Nematodes

Nematodes, or roundworms, are a vast and diverse phylum within the animal kingdom, comprising over 25,000 described species and likely millions of unidentified ones (Davies & Elling, 2015). They inhabit virtually every ecosystem on Earth, from the depths of oceans to soil, freshwater bodies, and even Polar Regions. While the majority are free-living, many nematodes are parasitic, impacting humans, animals, and plants (Kumar et al., 2020).

Classification and Diversity

Nematodes are classified into various orders based on morphology, habitat, and parasitic adaptations. Key orders include:

1. **Strongylida**: Intestinal parasites such as hookworms (Necator americanus, Ancylostoma duodenale) and whipworms (Trichuris trichiura).
2. **Ascaridida:** Includes Ascaris lumbricoides, causing ascariasis, one of the most common human infections worldwide.
3. **Filariida:** Responsible for diseases like lymphatic filariasis (Wuchereria bancrofti) and onchocerciasis (Onchocerca volvulus).
4. **Trichocephalida:** Including whipworms affecting the large intestine.
5. **Rhabditida:** Free-living nematodes with some species capable of parasitizing humans.

IMPACT ON HUMAN HEALTH

Intestinal Nematodes

1. **Ascariasis:** Caused by Ascaris lumbricoides, affects over 800 million people globally, leading to intestinal obstruction, malnutrition, and impaired growth in children.
2. **Hookworm Disease**: Necator americanus and Ancylostoma duodenale cause chronic intestinal bleeding, iron deficiency anemia, and impaired physical and cognitive development, primarily affecting impoverished regions with poor sanitation.
3. **Whipworm Infection:** Trichuris trichiura leads to chronic dysentery, rectal prolapse, and growth stunting, particularly in children.

Tissue and Bloodborne Nematodes

1. **Lymphatic Filariasis:** Transmitted by mosquitoes carrying Wuchereria bancrofti, Brugia malayi, or Brugia timori, causing lymphedema, elephantiasis, and hydrocele.
2. **Onchocerciasis (River Blindness):** Spread by black flies (Simulium species), results in skin depigmentation, severe itching, and blindness due to ocular lesions.
3. **Trichinosis:** Contracted through eating undercooked pork containing Trichinella spiralis, causing muscle pain, fever, and potentially life-threatening complications such as myocarditis.
4. **Toxocariasis:** Caused by Toxocara species, primarily affecting young children who ingest contaminated soil or food, leading to visceral larva migrans and ocular larva migrans, with symptoms ranging from mild to severe, including neurological complications.

Other Significant Nematode Infections

1. **Strongyloidiasis:** Caused by Strongyloides stercoralis, leading to chronic diarrhea, abdominal pain, and potentially fatal disseminated disease in immunocompromised individuals.

2. **Dracunculiasis (Guinea Worm Disease):** Involves Dracunculus medinensis, contracted through drinking contaminated water, causing painful subcutaneous blistering and subsequent worm emergence.

ECONOMIC AND SOCIAL IMPLICATIONS

Global Burden of Disease

Nematode infections collectively impose a substantial burden on global health, particularly in developing regions lacking adequate sanitation and healthcare infrastructure. The socio-economic impact includes:

1. **Loss of Productivity:** Due to chronic illness, physical debilitation, and cognitive impairment, especially in children.
2. **Healthcare Costs:** Including treatment, hospitalization, and management of chronic complications (Singh, 2022).
3. **Educational Disruption:** Absenteeism and reduced educational attainment due to illness.

THERAPEUTIC POTENTIAL AND BIOLOGICAL INSIGHTS

Immunomodulatory Effects

Research into nematode infections has uncovered their complex interactions with the host immune system, revealing potential avenues for therapeutic intervention in autoimmune diseases and allergies through:

Helminth Therapy: Investigating the use of nematodes or their products to modulate immune responses and reduce inflammation in conditions like inflammatory bowel disease (IBD), multiple sclerosis (MS), and asthma. (Safiuddin & Mahmood, 2017).

Biomedical Applications

1. **Bioactive Molecules:** Nematodes produce various bioactive compounds with pharmaceutical potential, including antibiotics, anti-inflammatories, and antiparasitics.
2. **Genetic and Developmental Studies:** Utilizing nematodes like Caenorhabditis elegans as model organisms for studying genetic pathways, development, and neurobiology, offering insights into human disease mechanisms and potential therapeutic targets.

CONTROL AND PREVENTION STRATEGIES

Public Health Interventions

1. **Mass Drug Administration (MDA):** Deploying anthelmintic drugs such as albendazole, mebendazole, and ivermectin in endemic areas to reduce transmission and morbidity.
2. **Sanitation Improvement:** Promoting access to clean water, proper sanitation facilities, and hygiene education to prevent fecal-oral transmission routes.
3. **Vector Control:** Targeting insect vectors (e.g., mosquitoes, black flies) through insecticide-treated bed nets, larviciding, and environmental management to reduce transmission of filarial nematodes. (Lima et al., 2018)

CHALLENGES AND FUTURE DIRECTIONS

Drug Resistance

Emerging resistance to anthelmintic drugs poses a significant challenge to nematode control efforts, necessitating:

1. **Development of New Therapeutics:** Including novel drug targets and formulations to combat resistant strains. (Jones et al., 2013).
2. **Integrated Approaches**: Combining drug therapy with vector control, sanitation improvements, and community engagement to achieve sustainable disease control (Khan & Quintanilla, 2023).

RESEARCH AND INNOVATION

Continued research is essential to:

1. **Expand Knowledge:** On nematode biology, host-parasite interactions, and environmental factors influencing transmission dynamics.
2. **Develop Vaccines:** Against nematode infections, although challenges such as antigenic variation and host specificity remain.

CONCLUSION

Nematodes represent a complex group of organisms with profound implications for

human health, ranging from debilitating parasitic infections affecting billions to potential biomedical applications and ecological interactions. Addressing nematode-related health challenges requires integrated approaches spanning public health, biomedical research, and sustainable development to alleviate the burden of disease and harness beneficial aspects of nematode biology for global health improvement. Further research and collaborative efforts are critical to achieving these goals and mitigating the socio-economic impact of nematode infections worldwide.

REFERENCES

Davies, L. J., & Elling, A. A. (2015). Resistance genes against plant-parasitic nematodes: a durable control strategy?. Nematology, 17(3), 249-263.

Jones, J. T., Haegeman, A., Danchin, E. G., Gaur, H. S., Helder, J., Jones, M. G., ... & Perry, R. N. (2013). Top 10 plant-parasitic nematodes in molecular plant pathology. Molecular plant pathology, 14(9), 946-961.

Khan, M. R., & Quintanilla, M. (Eds.). (2023). Nematode Diseases of Crops and Their Sustainable Management. Academic Press.

Kumar, V., Khan, M. R., & Walia, R. K. (2020). Crop loss estimations due to plant-parasitic nematodes in major crops in India. National Academy Science Letters, 43(5), 409-412.

Lima, F. S., Mattos, V. S., Silva, E. S., Carvalho, M. A., Teixeira, R. A., Silva, J. C., & Correa, V. R. (2018). Nematodes affecting potato and sustainable practices for their management. Potato: from Incas to all over the World, 107, 107-124.

Safiuddin, Rizvi, R., & Mahmood, I. (2017). Range of microbial disease complexes with Meloidogyne species and role of botanicals in management. Probiotics and plant health, 365-381.

Singh, A. K., Thakur, S. K., Keshari, N., Singh, N. K., Chand, R., Jeyakumar, P., & Priya, P. (2022). Nematode Management.

****