PriMera Scientific Surgical
Research and Practice
Volume 5 Issue 4 April 2025
DOI: 10.56831/PSSRP-05-175
ISSN: 2836-0028

PriMera Scientific Publications

Earthworms (Annelida: Oligochæta) as Medicine: A Meta-analysis

Type: Case Study
Received: March 10, 2025
Published: March 25, 2025

Citation:
John Warren Reynolds., et al. "Earthworms (Annelida: Oligochaeta) as Medicine: A Meta-analysis". PriMera Scientific Surgical Research and Practice 5.4 (2025): 05-09.

John Warren Reynolds[1,2]* and Wilma M Reynolds[1]

[1]*Oligochaetology Laboratory, 9-1250 Weber Street East, Kitchener, Ontario Canada N2A 4E1*

[2]*Research Associate, New Brunswick Museum, 277 Douglas Avenue, Saint John, New Brunswick, Canada E2K 1E5*

***Corresponding Author:** John Warren Reynolds, Oligochaetology Laboratory, 9-1250 Weber Street East, Kitchener, Ontario Canada N2A 4E1; Research Associate, New Brunswick Museum, 277 Douglas Avenue, Saint John, New Brunswick, Canada E2K 1E5.

Abstract

This manuscript discusses the use of earthworms and their extracts as used in ancient and recent medical practice. Although there have been many studies involved using earthworms for medical remedies, this report is restricted to those where the patients are humans vis-à-vis other animal species.

Keywords: earthworm extracts; medicine; treatments; *Lumbricus rubellus*; *L. terrestris*; *Eisenia fetida*

Introduction

When we began our study of earthworms in medicine, there was very little written about using earthworms in human medicine in the available literature (Reynolds and Reynolds, 1972, 1979) [24, 25]. This was confirmed by Cooper et al. (2004) [5] and Grdiša (2013) [11]. It has been suggested in the folk medicine (North American Indians, doctors in East Asia) that earthworms have been used for the treatment of various diseases (Cooper et al., 2004) [5]. They cite Price's (1901) [23] *Kentucky Folk-Lore* as a source, but our reading of the paper revealed no mention of earthworms.

We were aware of Stephenson's (1930) [31] short treatment of the subject in which he briefly mentioned Mustauft's (1340) [21] *Nuzhat-ul-Qulūb*, Damiri's (1371) [7] *Hayāt-ul-Hayāwān*, and Anglicus' (1582) [1] *Batman uppon Bartolome*.

The earliest records of earthworm's use in medicine can be found in old Chinese volumes which may be difficult for most westerners to decipher. These remedies involve several species of *Pheretima* or *Amynthas*, in Chinese "Dilong" [帝龍 or 蚯蚓地魔]. Their uses were varied, e.g., as an antipyretic and antiaesthetic, as well as for detoxification, hypertension, arthritis, burns, and inflammation (Huang, 1956) [16].

Case Studies

Gates (1926) [9] at the beginning of his career, reported on the use of earthworms in Burma for treating the symptoms of pyorrhea and postpartum weakness. The earthworms are boiled in water with salt and onions, the clear liquid is decanted and mixed with the patient's food.

Pharmaceutical effects of earthworm research have been initiated simultaneously with the development of biochemical technologies (Cooper et al., 2012) [6].

Many studies have involved earthworms used in medicine, but most have used animals for hosts such as rats, rabbits and mice, and with only a few species of earthworms, e.g. Li (1988) [19]. But studies using humans benefitting from earthworm extracts etc. have proliferated in recent decades (Grdiša et al., 2013) [12].

A mixture of fresh earthworm tissues and red sugar was applied to parts affected with erysipelas and some 11 patients were cured in 3 to 5 days. Erysipelas is a bacterial infection that affects the upper layers of the skin and the superficial lymphatic vessels (Vohora and Khan, 1978) [28].

Gates (1982) [10] reported fresh earthworms were stewed into an extract which was taken orally to treat 10 cases of sequelae (aftereffects) of encephalitis B, for 30 days, as a treatment and satisfactory therapeutic results were obtained.

Cooper and Roch (1984) [4] proposed the hypothesis of earthworm leukocyte interactions at early stages of tissue grafting based on their study where higher titres of erythrocyte agglutinins (red blood cell clumping) were measured after 24 hours since injection.

Also in that year, Wojdani et al. (1984) [35] cultured mouse and human lymphocytes with the earthworm (*Lumbricus terrestris*) coelomic fluid to determine their mitogenetic responses, i.e. where ultra-weak photon emissions, particularly in the ultraviolet range, are believed to influence cell division (mitosis) in nearby biological systems. Their research indicated that that the addition of agglutinin inhibitors (anti-clumping substances) or absorption from the coelomic fluid did not alter the levels of mitogenic activity. Their conclusion was the relationship between earthworm agglutinins and mitogens is problematic. This idea has sparked significant interest and research over the years, but it remains controversial due to challenges in reproducing the effects consistently.

Employing fresh earthworm extracts used to treat 381 cases of blood-deficiency apoplexy (= stroke) had an average effective cure rate of 79% (Guo et al., 1988) [13]. Zhang (1988) [39] treated vertigo, using an earthworm extract. His study had 32 treatments; 20 cases were fully cured (63%), two responded to the treatment (6%) and three had no effects (9%).

A sample of 15 earthworms were put into a sugar solution and soaked for 10 hours to produce an infusion. Using this earthworm infusion on the wounded surface, 50 cases of burns and scalds (10 to 110) recovered fully in one week (Zhang, 1990) [40]. Li (1988) [19] reported that the application to 5011 cases of burns and scalds (first and second degree) showed that 98.7% of wounds recovered fully. In 32 cases of serious burns and scalds, 23 were completely cured.

Mihara et al. (1991) [20] produced fibrinolytic enzymes from *Lumbricus rubellus* which they termed Lumbrokinase. These enzymes dissolve blood clots, which can be a significant problem after strokes, heart attacks, deep vein thrombosis and pulmonary embolisms.

The 5th most common cancer (Hepatocellular carcinoma) is also the 3rd leading cause of cancer-related mortality globally (Sherman and Takayama, 2004) [23]. Earthworm fibrolytic enzymes from *Eisenia fetida* showed significant antitumor activity, both in vitro and in vivo, through the introduction of apoptosis (cell death where cellular debris is recycled without causing inflammation) (Chen, 2001; Hu et al., 2002; Xie et al., 2003; Yuan et al., 2004) [3, 15, 36, 38].

Forty cases of digestive ulcers were given a dried earthworm powder taken orally at 2 g/dose, 3-4 times per day. This treatment fully cured 34 cases (85%) and six cases (15%) were improved (Yadav and Singh, 2006) [34].

Improving wound healing has been the focus of many scientists and those in the medical community for years. The process involved the re-epithelization and restoration of deeper connective tissue (Gailit and Clark, 1994) [8]. The migration of cells and tissue remodeling which take place during the course of the wound-healing process require controlled degradation of extracellular matter. The agents involved in this process contributing to better healing include earthworms' homogenate paste (Hrženjak et al., 1993; Popović et al., 2005) [14, 22]. Shetty and Biadar (2025) [29] also showed that *Eisenia fetida* extract can be used to treat various types of wounds with no side effects and it is also cost-effective.

Purified fibrinolytic enzymes from several earthworms, e.g. *Eisenia fetida* and *Lumbricus rubellus*, have preventive effects on thrombosis-related diseases (Grdiša et al., 2013; Sun, 2015) [12, 31].

Reynolds (2024) [26] presented an indirect method whereby earthworms might be able to restrict the spread of tick-borne diseases, such as lyme disease, by disrupting the life cycle of the black-legged tick (*Ixodes scapularis* Say, 1821) [27] which is the vector of the *Borrelia burgdorferi* Johnson et al. 1984 [17] emend. Baranton et al. 1992 [2], which causes a bacterial spirochete infection. This results in over 300,000 cases annually in North America.

Conclusions

The present review provides various therapeutic uses of earthworms to treat many human ailments. For centuries, earthworms have been used as a drug to improve blood circulation, anti-tumor activity, detoxification, hypertension, arthritis, burns, and inflammation. This has led to an increased search for naturally occurring therapeutic agents. Earthworms are of interest to the pharmaceutical industry as a source of a wide variety of biological active components (Figure 1). Scientific investigations are needed to discover new therapeutic agents of zoological origin which might be very specific to treat certain diseases and conditions, thus far incurable in modern medicine. In view of the enormous potential of earthworms to treat many diseases and pathological conditions as indicated in preliminary clinical and pharmacological investigations, detailed scientific studies are suggested to develop new therapeutics of animal origin.

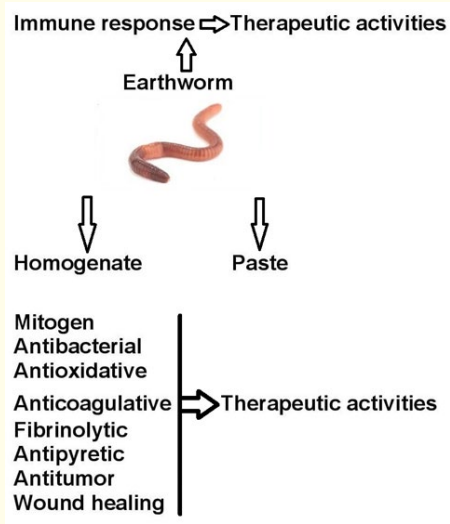

Figure 1: The properties of earthworm macromolecules which contribute to their therapeutic activities (modified from Grdiša, 2013).

References

1. Anglicus B. "Batman uppon Bartolome. [his booke, De proprietatibus rerum, newly corrected, enlarged and ammended: with such additions as are requisite, unto every severall booke]". London: Thomas East, 1582; 11 pages, 12 unnumbered pages, 426 leaves; (folio).
2. Baranton G., et al. "Delineation of *Borrelia burgdorferi* sensu stricto, *borrelia garinii* sp. nov., and group VS461 associated with lyme borreliosis". International Journal of Systematic Bacteriology 42 (1992): 378-383.
3. Chen H. "Anti-tumor effect of earthworm extracts EE2". Chinese Clinical Oncology 6 (2001): 349-350.
4. Cooper EL and Roch P. "Earthworm leukocyte interactions during early stages of graft rejection". Journal of Experimental Zoology 232.1 (1984): 67-72.
5. Cooper EL, Ru B and Weng N. "Earthworms: sources of antimicrobial and anticancer molecules". Advances in Experimental Medicine and Biology 546 (2004): 359-389.
6. Cooper EL., et al. "Earthworms Dilong: Ancient, Inexpensive, Noncontroversial Models May Help Clarify Approaches to Integrated Medicine Emphasizing Neuroimmune Systems". Evidence-Based Complementary and Alternative Medicine 2012.164152 (2012): 1-11.
7. Damīrī M ibm M. "Hayāt-ul-Hayāwān (a zoological lexicon)". [Jayakar, A.S.G. (ed. and transl., 1844)] 1371.
8. Gailit J and Clark RAF. "Wound repair in the context of extracellular matrix". Current Opinion in Cell Biology 6 (1994): 717-725.
9. Gates GE. "The Earthworms of Rangoon". Journal of the Burma Research Society 25 (1926): 196-221.
10. Gates GE. "Farewell to North American megadriles". Megadrilogica 4.1-2 (1982): 12-77.
11. Grdiša M. "Therapeutic properties of earthworms". Bioremediation, Biodiversity and Bioavailability 7.1 (2013): 1-5.
12. Grdiša M, Gršić K and Grdiša MD. "Earthworms - role in soil fertility to the use in medicine and as a food". Invertebrate Survival Journal 10 (2013): 38-45.
13. Guo FT, Gao BL and Chen GG. "Preliminary study on the therapeutic effect and pharmacological action of an earthworm extract". Journal of Integrated Chinese and Western Medicine 8.7 (1988): 400-401.
14. Hrženjak M., et al. "Fibrinolytic and anticoagulative acivities from the earthworm *Eisenia fetida*". Comparative Biochemistry and Physiology 119.B (1993): 825-832.
15. Hu YL., et al. "Study of earthworm extracts on the immunological activity and anti-tumor effects". Biotechnology (China) 12 (2002): 9-10.
16. Huang H. "Ten key formula families in Chinese medicine". (transl. M. Max). Seattle, WA: Eastland Press (1956): 337.
17. Johnson RC., et al. "*Borrelia coriaceae* sp. nov.: putative agent of epizootic bovine abortion". International Journal of Systematic Bacteriology 37 (1987): 72-74.
18. Kuehn BM. "CDC estimates 300,000 US cases of Lyme disease annually". Journal of the American Medical Association 310.11 (2013): 1110.
19. Li Y. "Influence of thrombosing on rabbit". Acta Chinese Medcine and Pharmacology 2 (1988): 46.
20. Mihara H., et al. "A novel fibrinolytic enzyme extracted from the earthworm, *Lumbricus rubellus*". Japanese Journal of Physiology 41 (1991): 461-472.
21. Mustauft, H. "Nuzhat-ul-Qulūb (نزهةالقلوب, 'Hearts' Bliss)". In: Lewis, B., V.L. Ménage, Ch. Pellat and J. Schacht. (eds.). The Encyclopaedia of Islam, 2nd ed. Volume III: H-Iram. Leiden: E.J. Brill (1340): 1270.
22. Popović M, Grdiša M and Hrženjak T. "Glycolipoprotein G-90 obtained from the earthworm *Eisenia foetida* exerts antibacterial activity". Veterniary Archives 75 (2005): 119-125.
23. Price SF. "Kentucky Folk-Lore". The Journal of American Folklore 14.52 (1901): 30-39.
24. Reynolds JW and Reynolds WM. "Earthworms in medicine". American Journal of Nursing 72.7 (1972): 1273.
25. Reynolds JW and Reynolds WM. "Earthworms in medicine". The Vermiculture Journal 2.1 (1979): 6-7.
26. Reynolds JW. "Could earthworms reduce the spread of tick-borne diseases like Lyme Disease?". International Journal of Current Research in Science, Engineering and Technology 7.2 (2024): 51-50.

27. Say T. "Descriptions of the Arachnides of the United States". Journal of the Academy of Natural Sciences of Philadelphia 2.1 (1821): 59-81.
28. Sherman M and Takayama Y. "Screening and treatment for hepatocellular carcinoma". Gastroenterology Clinics of North America 33 (2004): 671-691.
29. Shetty A and Biadar PM. "Evaluation of the wound healing activity of the epigeic earthworm, *Eisenia fetida* extract". Proceedings of the National Academy of Sciences, India Section B: Biological Sciences (2025).
30. Shihara K and Nakajima N. "Stereoselective reduction of carbonyl compounds using the cell-free extract of the earthworm, *Lumbricus rubellus*, as a novel source of biocatalyst". Bioscience, Biotechnology, and Biochemistry 70 (2006): 3077-3080.
31. Stephenson J. "The Oligochaeta". Oxford: Clarendon Press (1930): 978.
32. Sun Z. "Earthworm as a biopharmaceutical: from traditional to precise". European Journal of BioMedical Research 1.2 (2015): 28-35.
33. Vohara SB and Khan SY. "Animal Origin Drugs used in Unani Medicine". Indian Journal of Pharmacology 10 (1978): 255.
34. Wilson CH., et al. "Surveillance for *Ixodes scapularis* and *Ixodes pacificus* ticks and their associated pathogens in Canada, 2019". Canadian Commun Disease Report 48.5 (2022): 208-218.
35. Wojdani A., et al. "Mitogenic effect of earthworm (*Lumbricus terrestris*) coelomic fluid on mouse and human lymphocytes". Immunnobiology 166.2 (1984): 157-167.
36. Xie JB., et al. "Extraction and isolation of the anti-tumor protein components from earthworm (*Eisenia foetida* [sic] Andrei) and the anti-tumor activity". Chinese Journal of Biochemistry and Molecular Biology 36 (2003): 375-279.
37. Yadav S and Singh VK. "Need for organic farming in cultivation of medicinal crops in India". In: Recent Progress in Medicinal Plants -Biopharmaceuticals. Houston, TX: Stadium Press (2006): 833.
38. Yuan I, Xu JM and Zhou YC. "Effects of the purified earthworm extracts on various hemal tumor cells". Clinical Medical Journal (China) 11 (2004): 177-179.
39. Zhang F. "Killing sperm and its effective ingredients". Journal of Shanxi Traditional Chinese Medical College 11 (1988): 30.
40. Zhang L. "Pharmacological study and clinical application of earthworm". Fujian Journal of Traditional Chinese Medicine 2 (1990): 52.