

## Documents

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**Development of Leech extract as a therapeutic agent: A chronological review**  
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**Abstract**

**Introduction:** Leech extract contains many identified bioactive substances which have a variety of biological effects. Leech extract was discovered in the late 19th century and since then many pharmaceutical products have been produced using leech extract for different ailments, but many have been withdrawn. Ongoing studies focus on developing health authority compliant pharmaceuticals to be used as modern medicine. **Methodology:** The online databases including Google Scholar, Scopus, PubMed, and Web of Science, were searched using different keywords: "Leech", "Leech extract", "Leech salivary gland extract" and "Leech saliva extract". The purpose of this review was to discuss the development of leech extract as a therapeutic agent, including the evolution of extraction techniques, and the successful manufacturing of leech extract-based pharmaceuticals. **Results:** Leech extract has been successfully developed as a therapeutic agent. Some of the developed leech extract-based pharmaceuticals were withdrawn and some are still in the market. The extraction methods played a vital role in the quality and efficacy of leech extract-based pharmaceuticals and ultimately on their sustainability in the market. Also, the full characterization of leech extract components is a key factor in the development of leech extract as a therapeutic agent. **Discussion:** This review provides a comprehensive historical perspective on the development of leech extract therapy, exploring its various stages of development and the key scientific and medical advances that have shaped its current state. The discussion also delves into potential future applications. **Conclusion:** Leech extract is an invaluable source of bioactive substances that can be utilized for the treatment of mild and life-threatening medical disorders. This review will encourage other scientists to continue their research on leech extract, especially in the areas of formulation and marketing. © 2023 The Author(s)

**Author Keywords**

Hirudotherapy; Leech; Leech extract; Leech saliva extract

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