

## Original Article

# Investigation of publication trends and hot topics on onchocerciasis between 2000 and 2022

Sevil Alkan<sup>1</sup>, Esra Gürbüz<sup>2</sup>, Selahattin Aydemir<sup>3</sup>

- 1- Department of Infection Diseases and Clinical Microbiology, Faculty of Medicine, Çanakkale Onsekiz Mart University, Çanakkale, Turkey
- 2- Department of Infection Diseases and Clinical Microbiology, Van Training and Research Hospital, Van, Turkey
- 3- Department of Parasitology, Van Yuzuncu Yıl University, Faculty of Medicine, Van, Turkey

\*Corresponding author: [s-ewil@hotmail.com](mailto:s-ewil@hotmail.com)

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## Abstract

This study aimed to use bibliometric tools to investigate onchocerciasis research conducted worldwide between 2000 and 2022. This bibliometric study was carried out using the Scopus database. The analysis unit was the documents conducted on onchocerciasis between 2000 and 2022. The data obtained after the last evaluations were transferred to VOSviewer (VOSviewer 1.6.19 for Microsoft Windows systems) and biblioshiny (bibliometrix R package) programs for analysis. The present results showed that 1026 documents on onchocerciasis were indexed in the Scopus database between 2000 and 2022. 2554 authors have published this literature, and the annual growth rate was 1.34 %. Forty-one articles were published in 2000, and after 2014, there was an increase in the number of articles. The most publications were published in 2018 (n = 82). PLOS Neglected Tropical Diseases (n = 97) and Parasites & Vectors (n = 46) published the most publications on onchocerciasis. Most of the publications were published by authors from the United States (n = 341), the United Kingdom (n = 228), Cameroon (n = 150), Nigeria (n = 132), and Germany (n = 120). The documents originating from the United States (n = 2372) had the highest citation numbers. The onchocerciasis research landscape between 2000 and 2022 is outlined in this report. Furthermore, the analysis offers an enhanced comprehension of the trends in onchocerciasis development over the previous 23 years, which might serve as a scientific benchmark for subsequent research.

**Keywords:** Bibliometric analysis, Onchocerciasis, *Onchocercus volvulus*, publication

## Introduction

Onchocerciasis (also called river blindness), is brought on by a parasitic microfilariae named *Onchocercus volvulus*, which is a major contributor to blindness (Connor, 1976). *O. volvulus* affects the skin, subcutaneous tissues, and

eyes. Infected blackflies (*Simulium spp.*), which breed in rivers, serve as the parasite's intermediate hosts and transmit the disease (Brattig et al., 2021). John O'Neill first identified microfilariae in 1874 (O'Neill, 1875). The adult microfilaria-releasing worms had been first identified by Patrick Manson

in 1890, and Rudolf Leuckart described their appearance from subcutaneous infestations as "*Filaria volvulus*" in 1893. These worms are now known as *O. volvulus* (Brattig et al., 2021). According to estimates, *O. volvulus* has infected 40 million people, and of those, 5% are blind as a result of this infection (Connor, 1976; WHO, 2020). According to the Global Burden of Disease Study 2017, at least 220 million people needed onchocerciasis preventive chemotherapy, 14.6 million of those infected had skin disease currently, and 1.15 million had vision loss (WHO, 2020). Onchocerciasis is endemic in tropical Africa, South America, and the Arabian Peninsula (Connor, 1976; Enk et al., 2003). The disease mostly affects sub-Saharan Africa, although it is also present in Yemen and, until the 2010s, in foci in six Central and South American nations (WHO, 2020). In accordance with the goals outlined in the 2030 Roadmap for neglected tropical diseases, a new World Health Organization (WHO) network seeks to ensure that onchocerciasis will soon be eradicated (WHO, 2022).

It causes commonly non-specific skin signs, including atrophy, severe pruritus, acute and chronic dermatitis, hypopigmented or hyperpigmented papular dermatitis, hypopigmentation that resembles vitiligo, and acute dermatitis (Vernick et al., 2000; Enk et al., 2003). The microfilariae can infiltrate any area of the eye and ocular structure by migrating to superficial tissues. Although living worms don't do much harm once they die, a localized inflammation results that can cause blindness (Berger and Nnadozie, 1993). There is a wide range of onchocercal ocular symptoms, and it can result in blindness (Connor, 1976; Enk et al., 2003). The disease's primary cause of blindness is sclerosing keratitis, which has a significant corneal involvement (Berger and Nnadozie, 1993). Onchocerciasis is typically associated with blindness and skin diseases, but there are reports of an association with epilepsy (Siewe Fodjo et al., 2019; Hadermann et al., 2023). According to a meta-analysis, there is a 0.4% rise in the prevalence of epilepsy for every 10% increase in the

prevalence of onchocerciasis (Pion et al., 2009). It is thought that Nodding syndrome and Nakalanga syndrome are clinical manifestations of epilepsy that have only been discovered in regions with a high onchocerciasis transmission rate (Colebunders et al., 2019). The underlying pathophysiology of how *O. volvulus* may cause seizures is still unknown (Siewe Fodjo et al., 2019). Typically, a diagnosis is made by examining the larvae that emerge from "skin snips," or superficial skin biopsies. In some situations, as the microfilariae move into the anterior chamber of the eye, they can also be seen directly with a slit lamp (Enk et al., 2003).

Although onchocerciasis has been well-known in medicine for more than a century, scientific treatment of this disease has only recently begun (Stingl, 1987). Currently, the medicine of choice for both cutaneous and ocular symptoms is ivermectin because of its excellent microfilaricidal activity (Enk et al., 2003). But, pregnant and nursing women, kids under 5, persons with asthma, and those suffering from other medical conditions should not receive ivermectin treatment (Berger and Nnadozie, 1993).

Alan Pritchard introduced the idea of bibliometrics in the late 1960s and defined it as "the application of mathematical and statistical methods to books and other media of communication" (Pritchard, 1969). Although this disease, which is a major cause of blindness in the world, has been included in the WHO 2030 Roadmap, no bibliometric analysis has been published yet. We conducted a bibliometric analysis, focusing on the published literature on onchocerciasis.

## Materials and methods

### Study design

We performed a bibliometric methodology in this study to analyze the onchocerciasis publications. We selected only one database to perform the study. We believed that Elsevier's Scopus database (www.scopus.com) would be more appropriate for this analysis, as this database offers the most complete coverage of scientific literature. To broaden our search, we used the following search

terms within the TITLE format: river blindness\* OR onchocerciasis OR *Onchocercus volvulus* OR *O. volvulus*. Then, we focused our search by only including documents from the years 2000 to 2022 (the year 2023 was left out because it has not yet been finished), with no language restriction, and the sources were books, journal articles, conference proceedings, or book chapters. Search results were exported to Microsoft Excel, where duplicates were checked for removal. We adhered to specific procedures since bibliometric analysis is a rigorous methodology, as described in other articles on the bibliometric approach (Leal Filho et al., 2022). Selected publications were downloaded to the computer according to the study protocol. The data was reviewed by two researchers. Publications irrelevant to the study topic, publications that did not comply with the study protocol, and duplicate publications were excluded.

#### *Statistical analysis*

The data obtained after the last evaluations were transferred to VOS viewer (version VOS viewer 1.6.19 for Microsoft Windows systems) (Van Eck and Waltman, 2014; Perianes-Rodriguez et al., 2016) and Biblioshiny (*bibliometrix* R package) (Aria and Cuccurullo, 2017) programs for analysis. Also, we used the Scopus database's graphics tools for visualizations.

#### *Bibliometric metrics*

A scientist's performance has been assessed using bibliometric metrics. The Hirsch index (H-index) has become increasingly recognized as the best parameter for this use (Kellner et al., 2008). We

used total publications numbers, H-index, and total citations (with or without self-citations).

## **Results**

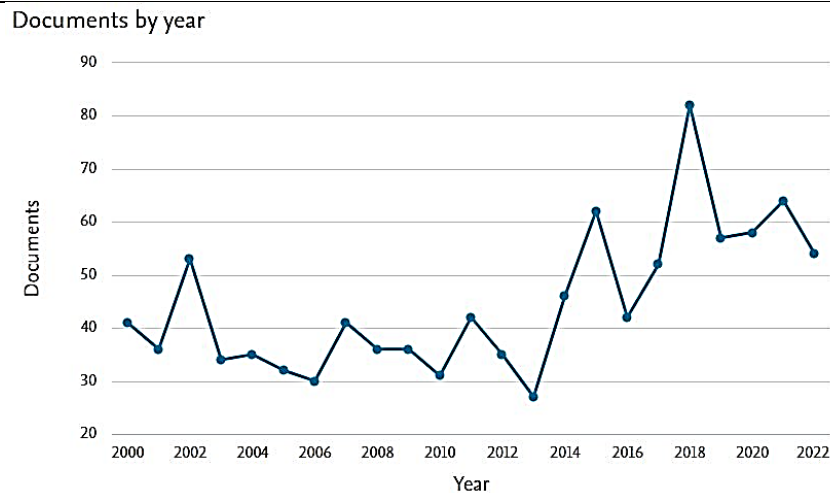
### *The fundamental features of documents*

In this bibliometric study, 1026 documents published between 2000 and 2022 on the subject of onchocerciasis were analyzed according to the inclusion criteria. 2554 authors have published this literature, and the annual growth rate was 1.34 %. According to the Biblioshiny program, the general characteristics of publications published between 2000 and 2022 are summarized in Supplementary Table 1.

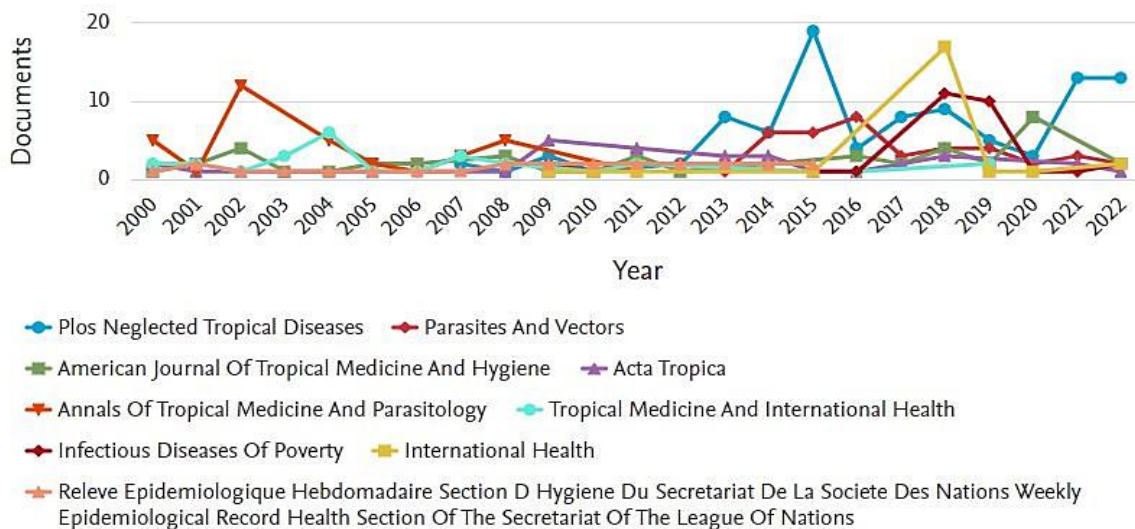
Figure 1 was obtained from the Scopus database's graphics tools. Figure 1 summarizes the number of articles over the years. According to the number of publications, forty-one articles were published in 2000, and after 2014, there was an increase in the number of documents. The highest number of publications was published in 2018 (n=82). After 2019, the number of publications decreased again (Figure 1).

### *Mostly published journals*

PLOS Neglected Tropical Diseases (n = 97), Parasites & Vectors (n = 46), and the American Journal of Tropical Medicine and Hygiene (n = 45) published the most publications on onchocerciasis between 2000 and 2022 (Supplementary Table 2). The number of publications according to the journals with the highest number of publications was visualized in Figure 2 with the help of the Scopus database's graphics tools.



**Fig. 1.** Documents published between 2000- 2022.

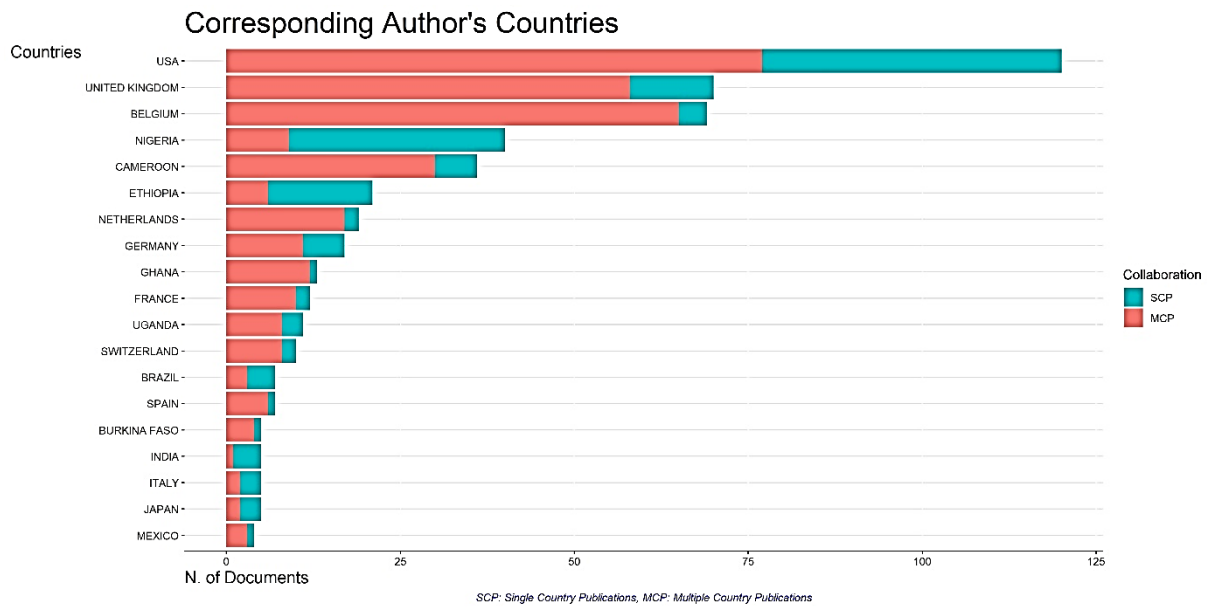


**Fig. 2.** Documents per top publishing sources.

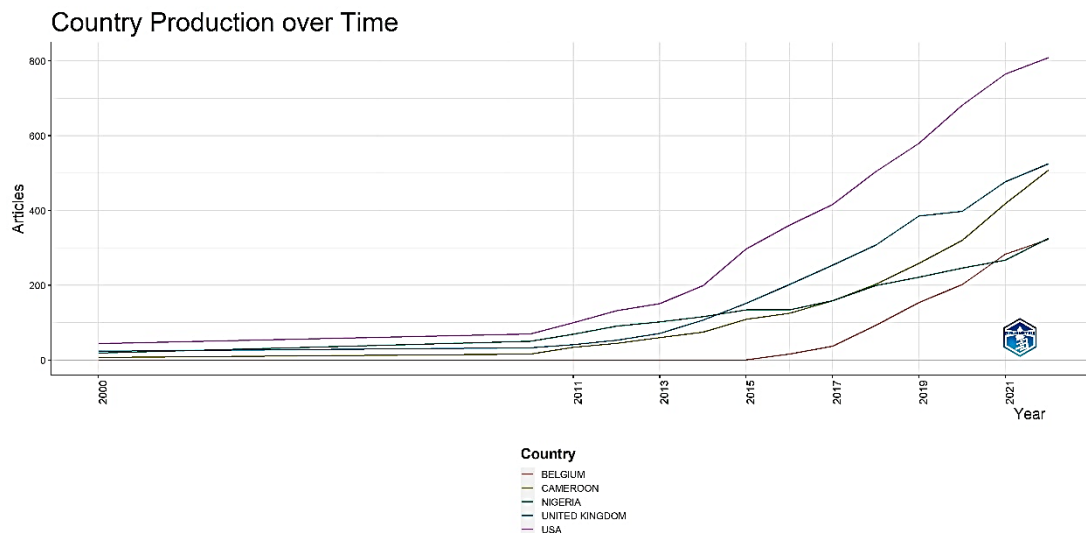
### *Mostly published countries, affiliations, and funding agencies*

Most of the publications were published by authors from the United States ( $n = 341$ ), the United Kingdom ( $n = 228$ ), Cameroon ( $n = 150$ ), Nigeria ( $n = 132$ ), Germany ( $n = 120$ ), Belgium ( $n = 98$ ), France ( $n = 89$ ), and Burkina Faso ( $n = 81$ ). Figure 3a and Figure 3b were generated with the Biblioshiny program. In Figure 3a, the countries of the corresponding authors of the publications are visualized with the Biblioshiny program. Publications in red are multi-author publications,

and those in green are single-author publications. Figure 3b also visualizes the distribution of the number of publications of the top publishing countries by year. The number of publications in the United States, the United Kingdom, Nigeria, and Cameroon began to increase after 2011, while those in Belgium began to increase after 2015. A maximum number of documents were published by the University of Antwerp (Belgium) (Supplementary Table 3). Most of the studies ( $n = 71$ ) were funded by the Bill and Melinda Gates Foundation (Supplementary Table 4).



**Fig. 3a.** Corresponding Authors and Countries.



**Fig. 3b.** Countries and production over time.

*The bibliographic coupling and citing analysis*

The bibliographic coupling map of the countries which published more than five documents were visualized in Figure 4 with the Vosviewer program. According to this, there were 38 countries with more than five publications among 76 countries published on onchocerciasis between 2000 and

2022. A link between two items that cite the same publication is referred to as a bibliographic coupling link. A link is a relationship or connection between two things. Examples include co-authorship links between researchers, bibliographic coupling links between publications, and co-occurrence links between terms. Typically,



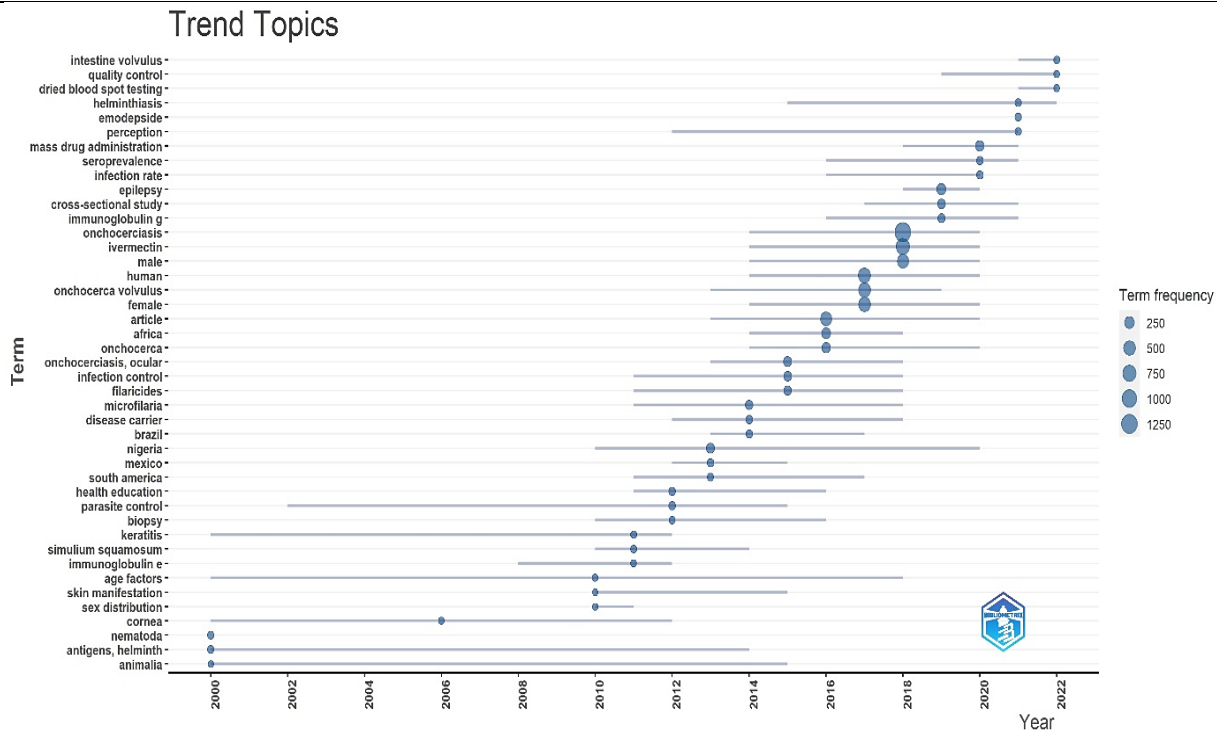


Fig. 6. Trend topics.

## Discussion

Bibliometric studies on zoonotic diseases, including neglected tropical diseases, have been published in increasing numbers in recent years (Soosaraei et al., 2018; Ellis et al., 2020; Keighobadi et al., 2021; Musa et al., 2021; Durgun et al., 2022; Ekici et al., 2022). The current study aimed to investigate publication trends and hot topics related to onchocerciasis between 2000 and 2022, one of the topics of interest for the WHO. The overall objective of the current study was to do a bibliographic review utilizing scientometric methods on 23 years of onchocerciasis research output. According to our literature review, this is the first published bibliometric study in this field. Given the significance of onchocerciasis research to global health, it has become crucial to develop a complete picture of the state of research in this area, along with an understanding of the research output and scientific collaborations in the field of research. Planning and policy-making may benefit from this data.

Although it is possible to use different databases in bibliometric studies (Soosaraei et al., 2018; Ellis et

al., 2020; Keighobadi et al., 2021; Musa et al., 2021; Cinpolat, 2022; Durgun et al., 2022; Ekici et al., 2022; Akar, 2023; Çelik et al., 2023), we preferred the Scopus database rather than the Web of Science database because we wanted to evaluate global research on onchocerciasis more comprehensively. Because the Web of Science database, commonly used in bibliometric studies, indexes fewer journals than the Scopus database. The Scopus database is also multidisciplinary and unique, and it is frequently used in similar publications.

Although it is also found in Yemen and, until the 2010s, in foci in six Central and South American countries, the disease primarily affects sub-Saharan Africa (WHO, 2020). Although WHO aims to ensure that onchocerciasis will soon be eradicated in accordance with the objectives established in the 2030 Roadmap for neglected tropical diseases (WHO, 2022), the scientific publications on onchocerciasis between 2000 and 2014 were limited, according to our study findings. After 2014, there has been an increase in the number of documents. The highest number of

publications was published in 2018 (n = 82), but there was a decrease in the number of publications after 2019. This may be due to the impact of the global COVID-19 pandemic on the scientific field. Researchers who participate in onchocerciasis research have ties to various nations and organizations. However, the top authors on the list were from the United States, the United Kingdom, Cameroon, Nigeria, Germany, and Belgium. Onchocerciasis is primarily endemic in regions of Yemen and Africa (Schmidt et al., 2022). Even though the majority of onchocerciasis research has originated from African nations, for understandable reasons such as the disease's higher prevalence rate, the funding for this research came primarily from various international funding agencies from developing countries. A geographical analysis of the prevalence of onchocerciasis in Africa and Yemen between 2000 and 2018 found that the prevalence of this infection continues to be concentrated in central and western Africa, with the highest average estimates of prevalence in Ghana (12.2%) and a national average of 5% reported for Cameroon, Central African Republic, Democratic Republic of Congo, Guinea-Bissau, Sierra Leone, and South Sudan (Schmidt et al., 2022). In our study, Yemen was not among the countries with the most publications. Although there were broadcasts from Cameroon and Nigeria, there were less than expected broadcasts from other African countries.

The main strategy advised for hindering its transmission is preventive chemotherapy combined with widespread ivermectin administration (Schmidt et al., 2022). The United States, the United Kingdom, Cameroon, and Belgium were some of the exciting spots where researchers from throughout the world collaborated on onchocerciasis studies. Collaboration between researchers in other countries and the sharing of knowledge can be crucial in the battle against and prevention of this disease. The United States has produced the most scientific research on onchocerciasis over the past 23 years, but a look at the map below shows that researchers in this country have collaborated more with their

counterparts in other countries than in other countries such as the UK and African countries, and they intend to conduct more research on onchocerciasis in the whole country.

To confirm the cessation of *O. volvulus* parasite transmission and, ultimately, its elimination, the WHO offers a set of recommendations that national program managers should follow in conjunction with their respective oversight committees. These recommendations include when to stop mass drug administration and conduct post-treatment surveillance activities for a minimum of 3 to 5 years. Before the International Verification Team and the WHO Director-General may formally declare the cessation of parasite transmission throughout the whole endemic country, additional measures must be taken (WHO, 2016).

By aerially spraying black fly breeding sites solely from one nation, the WHO Onchocerciasis Control Program in 11 countries of West Africa has completely lowered the risk of onchocerciasis (Berger and Nnadozie, 1993). Ivermectin has been widely prescribed in the Mime River Valley in Cameroon for over 15 years (Nji et al., 2021). Also, optometrists can play a vital role in onchocerciasis control and blindness prevention initiatives by teaching local healthcare providers to administer ivermectin in vision screening programs. Nigeria and Tanzania have optometry schools (Berger and Nnadozie, 1993). The hotspots in a certain research subject can be seen using keyword analysis of high frequency (Guo et al, 2019). We used key co-occurrence analysis to identify the main hotspots and directions and the evolution and changes in the theme structure. According to our findings from the analysis of frequently used keywords, it was observed that investigations related to the general characteristics of this parasite, prevalence, mass drug administration, infection control, health education, and ivermectin treatment were trending topics.

### **Limitations**

Due to the visualization programs used in this study, only one database (Scopus) was used. Scopus was chosen because it indexes more sources than the Web of Science. In addition, the



years 2000-2022 were chosen as the publication years. Therefore, it may not reflect the entire scientific literature.

### Conclusion

Numerous quantitative measures of research output have a positive correlation with academic rank. Bibliometric metrics could be helpful auxiliary tools for evaluating research production, even if academic promotion is the outcome of success in different fields. This study describes the onchocerciasis research characteristics from 2000 and 2022. The analysis also provides a better understanding of the trends in onchocerciasis development over the last 23 years, which could act as a scientific reference point for future research. In general, we found that the number of studies in this field is still not at the desired level. In the last 23 years, epidemiology, ivermectin treatment, mass drug administration, infection control, health education, and general knowledge of this parasite have been the trending topics in onchocerciasis publications. The United States and the United Kingdom had the most publications, but publications by authors from Africa have also been among the top publishing countries. However, in countries where the disease is endemic, such as Yemen, there were insufficient publications.

### Acknowledgments

Not applicable.

### Conflicts of Interest

The authors have no conflicts of interest to declare.

### Ethical approval

Not applicable.

### References

- A network to SEE river blindness GONE. World Health Organization. 20 October 2022. [Access date: 01. 04.2023] <https://www.who.int/news/item/20-10-2022-a-network-to-see-river-blindness-gone>
- Akar A. A Bibliometric Analysis Study on Percutaneous Dissectomy. *Journal of Contemporary Medicine*, 2023, 13(2), 176-81. doi: 10.16899/jcm.1214378
- Aria M., & Cuccurullo C. bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 2017, 11(4), 959-75. doi: 10.1016/j.joi.2017.08.007
- Berger I. B., & Nnadozie J. Onchocerciasis and other eye problems in developing countries: a challenge for optometrists. *Journal of the American Optometric Association*, 1993, 64(10), 699-702.
- Brattig N.W., Cheke R. A., & Garms R. Onchocerciasis (river blindness) - more than a century of research and control. *Acta Tropica*, 2021, 218, 105677. doi:10.1016/j.actatropica.2020.105677
- Colebunders R., Siewe Fodjo J. N., Hopkins A., Hotterbeekx A., Lakwo T. L., Kalinga A., Logora M. Y., & Basáñez M. G. From river blindness to river epilepsy: Implications for onchocerciasis elimination programmes. *PLoS Neglected Tropical Diseases*, 2019, 13(7), e0007407. doi:10.1371/journal.pntd.0007407
- Connor D, Neafie R. Onchocerciasis. In: Binford C, Connor D, editors. Pathology of tropical and extraordinary diseases. Washington, D.C.: *Armed Forces Institute of Pathology*; 1976. pp. 360-72.
- Cinpolat H. Y. A bibliometric analysis of global research trends on biomarker studies in Alzheimer's disease. *Demiroglu Science University Florence Nightingale Journal of Medicine*, 2022, 8(1), 5-10. doi:10.5606/fng.btd.2022.91
- Çelik M, Ceylan M.R., Arslan Y., Dinçer N. G., Alkan S. Bibliometric analysis of publications on Hepatitis D virus published in 1984-2022. *Central Asian Journal of Medical Hypotheses and Ethics*, 2023, 4(1), 22-33. doi:10.47316/cajmhe.2023.4.1.02
- Durgun C., Alkan S., Durgun M. & Dindar Demiray E. K. Türkiye'den Kist Hidatik Konusunda Yapılmış Yayınların Analizi. *Black Sea Journal of Health Science*, 2022, 5(1), 45-9. doi:10.19127/bshealthscience.937804
- Ekici A., Alkan S., Aydemir S., Gurbuz E., & Unlu A. H. Trends in Naegleria fowleri global research: A bibliometric analysis study. *Acta Tropica*, 2022, 234, 106603. doi:10.1016/j.actatropica.2022.106603.
- Ellis J. T., Ellis B., Velez-Estevez A., Reichel M. P., & Cobo M. J. 30 years of parasitology research analyzed by text mining. *Parasitology*, 2020, 147(14), 1643-57. doi: 10.1017/S0031182020001596

- Enk C. D., Gardlo K., Ruzicka T., & Ben Ezra D. Onchozerkose [Onchocerciasis]. *Der Hautarzt; Zeitschrift für Dermatologie, Venerologie, und verwandte Gebiete*, 2003, 54(6), 513–7. <https://link.springer.com/article/10.1007/s00105-003-0531-4>
- Guo S., Wang L., Xie Y., Luo X., Zhang S., Xiong L., Ai H., Yuan Z., Wang J. Bibliometric and Visualized Analysis of Stem Cells Therapy for Spinal Cord Injury Based on Web of Science and CiteSpace in the Last 20 Years. *World Neurosurg*, 2019, 132, e246–e58. doi:10.1016/j.wneu.2019.08.191
- Hadermann A., Amaral L. J., Van Cutsem G., Siewe Fodjo J. N., & Colebunders R. Onchocerciasis-associated epilepsy: an update and future perspectives. *Trends in Parasitology*, 2023, 39(2), 126–38. doi:10.1016/j.pt.2022.11.010
- Keighobadi M., Nakhaei M., Sharifpour A., Khasseh A. A., Safanavaei S., Tabaripour R., Aliyali M., Abedi S., Mehravaran H., Banimostafavi E. S., & Fakhar, M. A Bibliometric Analysis of Global Research on Lophomonas Spp. in Scopus (1933-2019). *Infectious Disorders Drug Targets*, 2021, 21(2), 230–7. doi:10.2174/1871526520666200727153142
- Kellner A. W., & Ponciano L. C. H-index in the Brazilian Academy of Sciences: comments and concerns. *Anais da Academia Brasileira de Ciências*, 2008, 80(4), 771–81. doi:10.1590/s0001-37652008000400016
- Leal Filho W., Ternova L., Parasnis S. A., Kovaleva M., & Nagy G. J. Climate Change and Zoonoses: A Review of Concepts, Definitions, and Bibliometrics. *International Journal of Environmental Research and Public Health*, 2022, 19(2), 893. doi:10.3390/ijerph19020893
- Musa H. H., Musa T. H., Musa I. H., & Musa I. H. Global scientific research progress in mycetoma: a bibliometric analysis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2021, 115(12), 1414–26. doi:10.1093/trstmh/trab072
- O'Neill S. On the presence of a filaria in “craw craw”. *The Lancet*, 1875, 105 (2686), 265–6. doi:10.1016/S0140-6736(02)30941-3 252
- Perianes-Rodriguez A., Waltman L., & Van Eck N.J. Constructing bibliometric networks: A comparison between full and fractional counting. *Journal of Informetrics*, 2016, 10(4), 1178–95. doi.org/10.1016/j.joi.2016.10.006
- Pion S. D., Kaiser C., Boutros-Toni F., Cournil A., Taylor M. M., Meredith S. E., Stufe A., Bertocchi I., Kipp W., Preux P. M., & Boussinesq M. Epilepsy in onchocerciasis endemic areas: systematic review and meta-analysis of population-based surveys. *PLoS Neglected Tropical Diseases*, 2009, 3(6), e461. doi:10.1371/journal.pntd.0000461
- Pritchard A. Statistical bibliography or bibliometrics? *Journal of Documentation*, 1969, 25, 348–9.
- Schmidt C. A., Cromwell E. A., Hill E., Donkers K. M., Schipp M. F., Johnson K. B., Pigott D. M., LBD 2019 Neglected Tropical Diseases Collaborators, & Hay S. I. The prevalence of onchocerciasis in Africa and Yemen, 2000-2018: a geospatial analysis. *BMC Medicine*, 2022, 20(1), 293. doi:10.1186/s12916-022-02486-y
- Siewe Fodjo J. N., Mandro M., Mukendi D., Tepage F., Menon S., Nakato S., Nyisi F., Abhafule G., Wonya'rossi D., Anyolito A., Lokonda R., Hotterbeekx A., & Colebunders R. Onchocerciasis-associated epilepsy in the Democratic Republic of Congo: Clinical description and relationship with microfilarial density. *PLoS Neglected Tropical Diseases*, 2019, 13(7), e0007300. doi:10.1371/journal.pntd.0007300
- Soosaraei M., Khasseh A. A., Fakhar M., & Hezarjaribi H. Z. A decade bibliometric analysis of global research on leishmaniasis in Web of Science database. *Annals of Medicine and Surgery* 2018, 26, 30–7. doi: 10.1016/j.amsu.2017.12.014
- Stingl P. Onchocerciasis. Übertragung--Klinik--Diagnose--Behandlung--Immunverhältnisse [Onchocerciasis. Transmission--clinical aspects--diagnosis--treatment--immune relations]. *Der Hautarzt; Zeitschrift für Dermatologie, Venerologie, und verwandte Gebiete*, 1987, 38(12), 709–15. <https://pascal-francis.inist.fr/vibad/index.php?action=getRecordDetail&idt=7559820>
- Van Eck N. J., & Waltman L. Visualizing bibliometric networks. In Y. Ding, R. Rousseau, & D. Wolfram (Eds.), *Measuring Scholarly Impact: Methods and Practice* 2014, 285–320 [https://link.springer.com/chapter/10.1007/978-3-319-10377-8\\_13](https://link.springer.com/chapter/10.1007/978-3-319-10377-8_13)
- Vernick W., Turner S. E., Burov E., & Telang G. H. Onchocerciasis presenting with lower extremity, hypopigmented macules. *Cutis*, 2000, 65(5), 293–7. <https://pubmed.ncbi.nlm.nih.gov/10826090/>
- Van Eck N. J., & Waltman L. VOSviewer Manual. Manual for VOSviewer version 1.6.19. 23 January 2023. [Access date: 01. 04.2023] [https://www.vosviewer.com/documentation/Manual\\_VOSviewer\\_1.6.19.pdf](https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.19.pdf)

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World Health Organization. Onchocerciasis. 2020. [Access date: 01. 04.2023] [https://www.who.int/health-topics/onchocerciasis#tab=tab\\_1](https://www.who.int/health-topics/onchocerciasis#tab=tab_1)

World Health Organization. Guidelines for Stopping Mass Drug Administration and Verifying Elimination of Human Onchocerciasis: Criteria and Procedures. (2016). Geneva: 2016. [Access

date: 24. 05.2023] <https://www.ncbi.nlm.nih.gov/books/NBK344121/>

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