

## Mapping Global Research Landscape ON THE Impact OF Sars Corona Virus ON Gut Health: A Bibliometric Analysis Study

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### Abstract:

*Background:* The gastrointestinal well-being of an individual is influenced by various external factors apart from dietary choices. These factors include lifestyle habits, medication usage (such as antibiotics), and microbial infections that primarily impact the host health.

*Method:* A search was conducted on the Web of Sciences, Scopus and PubMed database to retrieve all articles related to Gut Health and COVID-19. The search covered the time period from January 1, 2020 to December 2023.

*Results:* Notably United states of America have published a greater number of documents (662) published compared to other countries. Italy and Korea have least contribution towards publishing documents on Gut Health and Covid (19). The article authored by Chilkoti et al. stood out as the top-ranked publication with the highest number of NPL count 1255. The author's objective was to examine the alterations in gut microbiota in patients with COVID19 followed by Fan Christina et al al with Average cited NPL count = 730

*Conclusion:* To summarize, this study represents an initial bibliometric analysis conducted to assess the impact of COVID-19 on gut health. Among the countries actively contributing to gut health and COVID-19 research, the US ranks first. When it comes to journals in this field, Journal of Scientific reports have shown the highest productivity. The findings of this bibliometric analysis highlight that the most significant research topics revolve around Gastrointestinal symptoms associated with COVID-19: the impact on the gut microbiome. The emergence of these important topics related to gut health and COVID-19 can help researchers identify new research. areas in this domain.

**Keywords:** Bibliometric Analysis, Gut Health, Microbiota, Covid 19, Impact

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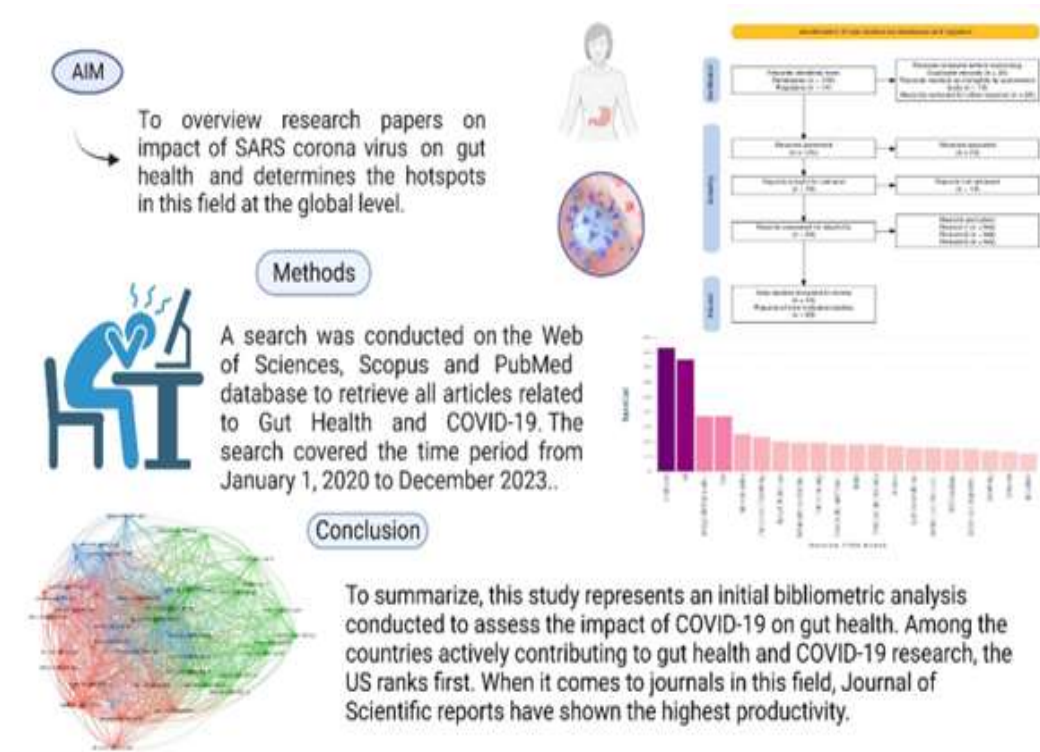
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## Graphical Abstract



### Introduction:

COVID-19, a worldwide illness caused by the SARS-CoV-2 virus, has swiftly propagate from China to chiefly all corners of the globe, provoking more than 800,000 individuals in 199 communities [1,2]. with COVID-19 showed no symptoms, a significant number of people had mild manifestations such as dry cough, sore throat, etc [3]. A small proportion of the affected population faced life-threatening intricacies, including organ failure, septic shock, pulmonary edema, severe pneumonia, and acute respiratory distress syndrome (ARDS) [4]. Those requiring intensive care were also more likely to report symptoms such as difficulty breathing, dizziness, abdominal pain, and loss of appetite [5]. The majority of hospitalized patients with severe symptoms belonged to the older age group or had pre-existing medical conditions [6]. Contemporary studies have shown that lung infections cause amendments in the gut microbiome [7]. The "gut-lung axis" serves as an indispensable means of intercommunication between the gut microflora and the lungs. Gut microflora has been observed to impact lung health through this connection. This communication is thought to be bidirectional, with endotoxins and microbial metabolites potentially affecting the lungs and prompting tenderness that may also concern the visceral microbiota [8]. The rigidity of viral infections is closely related to food input and the heterogeneity of intestinal microflora. It is fundamental to recognize the essential role of gut microflora in promoting overall well-being and mitigating the gruffness of disease and viral infections [9].

The visceral microbiome comprises a large and diverse community of approximately 100 million– 100 trillion microorganisms [10] These microorganisms impose a vital pursuit in immune and metabolic pathways and have an evocative strike on both the maintenance of health and the development of disease [11]. Intestinal microflora also plays a role in a number of physiological rebounds, beyond nutrient absorption, energy regulation, glucose metabolism, and immune system regulation [12]. Metabolites produced by gut microbiomes have the potential to modulate immune responses in a systematic manner. In addition, the disparity of the visceral microbiota is directly concurrent to the efficiency of

the host's immune system [13]. Dysbiosis of the human visceral microbiota is affiliated several health conditions, such as respiratory tract infections (RTIs), midst the visceral–lung axis [14]. Researchers have interconnected the visceral intestinal (GI) tract to the predisposition and stubbornness of infection of COVID-19 with the emergence of new strains [15].

In addition, the complexity of this system can also be disrupted by various factors, such as changes in lifestyle, nutrition, which have become particularly relevant in the context of the COVID-19 contagion [16]. Intestinal malnutrition has a direct strike on the embracing mucosa and obliquely weakens the immune response at the exterior surface of the lung mucosa, making individuals more vulnerable to systemic inflammation [17]. Consequently, it is crucial to upgrade the nutritional status of patients and strengthen their immune system by regulating the microbiota in order to effectively treat the novel coronavirus [18]. Visceral beneficial bacteria are live microorganisms that, when consumed in content amounts, afford health benefits to the host [19]. The most commonly used beneficial bacteria in dietary supplements include *Lactobacillus*, *Bifidobacterium*, *Saccharomyces* and *Bacillus*, with *Lactobacillus* being the most commonly used. *Bifidobacterium* and *Lactobacillus acidophilus* are mainly found in food products. In combination with an adapted diet, probiotics have the potential to balance the microflora and enhance the function of the recipient's immune system [20]. Probiotics can also help regulate exaggerated immune responses caused by antibiotics and the cytokine crisis associated with COVID-19. By reducing the cytokine crisis in the visceral-lung-brain axis, probiotics may contribute to the reduction of local and systemic inflammatory responses in COVID-19 [21]. A number of clinical trials have already achieved positive results in the treatment of COVID-19 by incorporating probiotics as an adjunctive therapy [22].

Recently, there have been many scientific papers discussing the correlation between the gut and COVID-19. However, the development of these publications was not subjected to bibliometric analysis. Therefore, it is essential to quickly summarize the publication propensity in this area of research so that future studies can use this inference as a cross reference point. Bibliometrics, a statistical approach, is used to mathematically analyze research articles related to a specific subject [23]. This study performed an in-depth investigation of the literature on the gut and COVID-19 by examining the Web of Science, Scopus and PubMed databases.

Materials and methods

### **Data sources**

Dimensions software is widely accustomed in bibliometric evaluation. It offers panoramic information and is considered the most dominant software in the field of bibliometrics.

Search strategy

Web of Sciences, Scopus, and PubMed databases were queried to find all articles related to gut health and COVID-19. The query covered the time period from January 1, 2020 to December 2023.

Inclusion and exclusion criteria

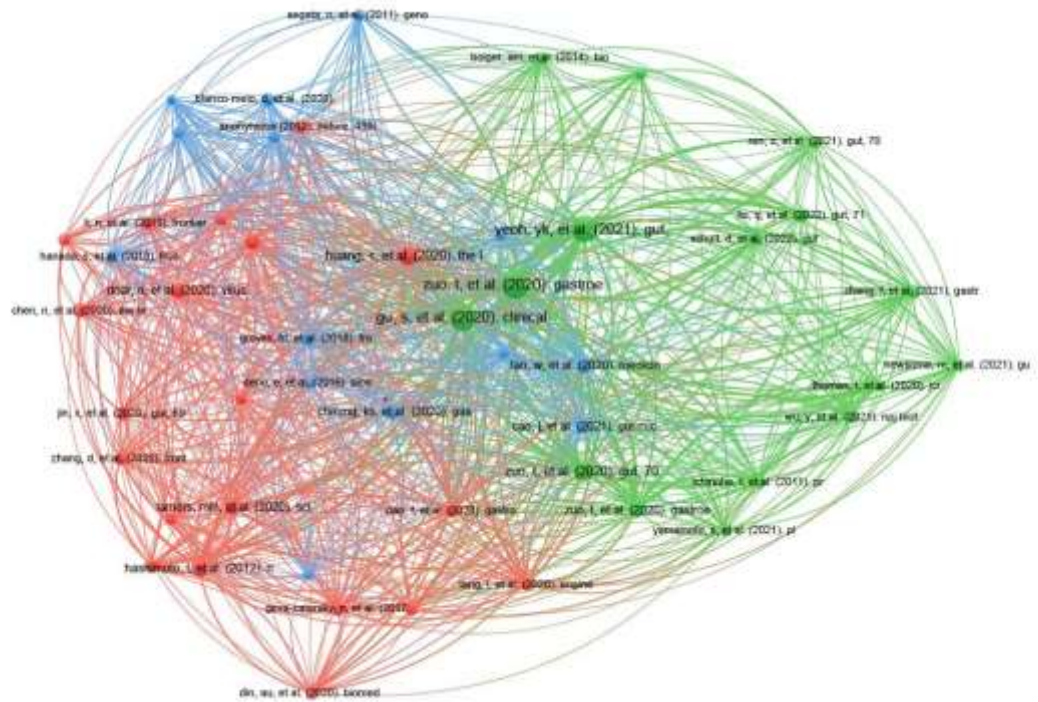
Inclusion strategy was as follows: manuscript engrossed on gut health and COVID-19 with accessible content; articles were the types of documents included in the study; and the articles were written in English. Exclusion strategy was as follows: main topics not affiliated to gut health or COVID-19; abstracts, reports, briefings, etc. were published as articles.

### **Bibliometric analysis**

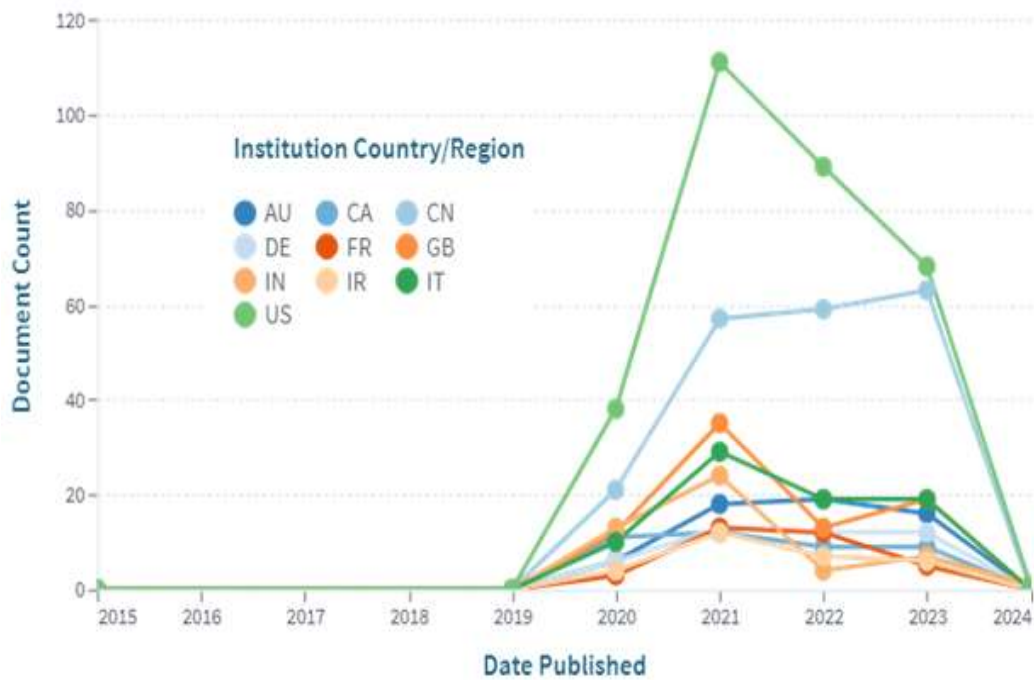
An outright of 135 articles were retrieved and impulsively investigated based on year of publication, country/region, research institution, author and journal. Microsoft Excel was

used to trail statistics of top countries/regions, research institutions, authors and journals in terms of number of publications. The results were registered in Excel documents. Publication data were visually analysed using the VOS viewer software developed by Leiden College in the Netherlands. This analysis included an analysis of collaboration between institutions, countries and regions, as well as an analysis of author citations and an analysis of journal citations.

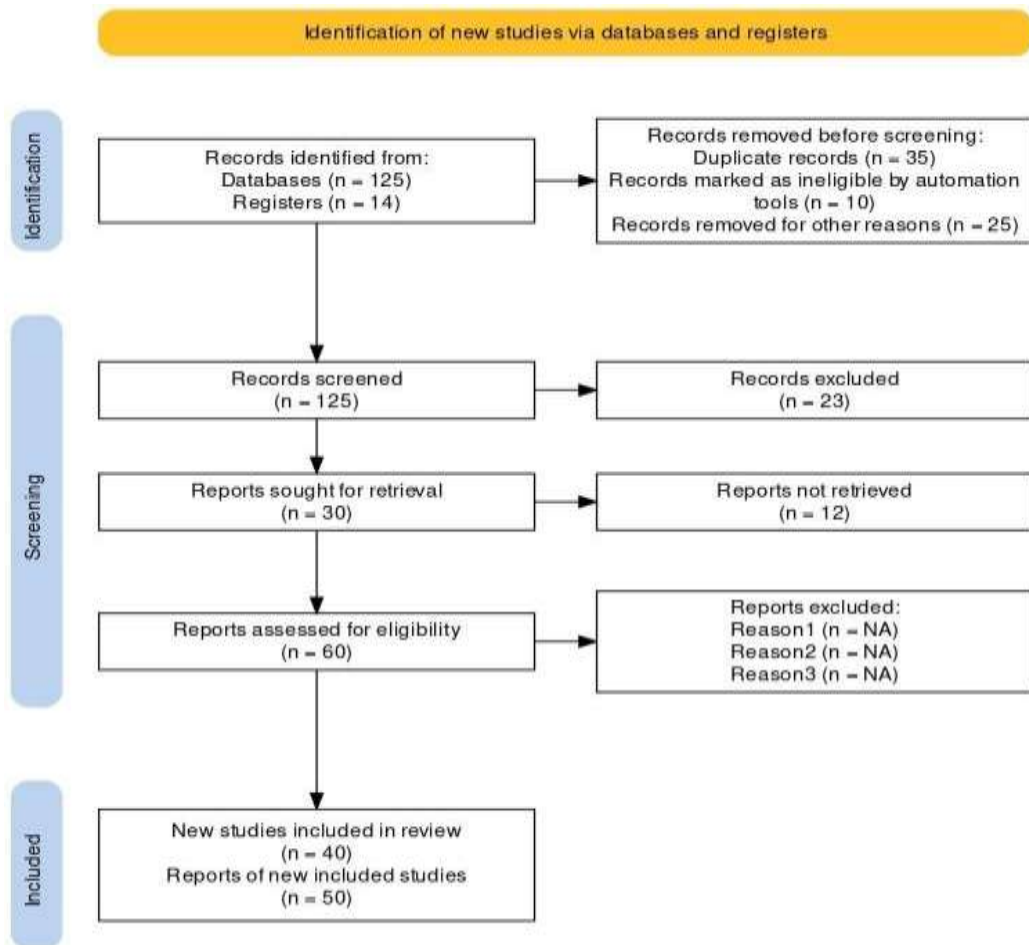
**Results:**



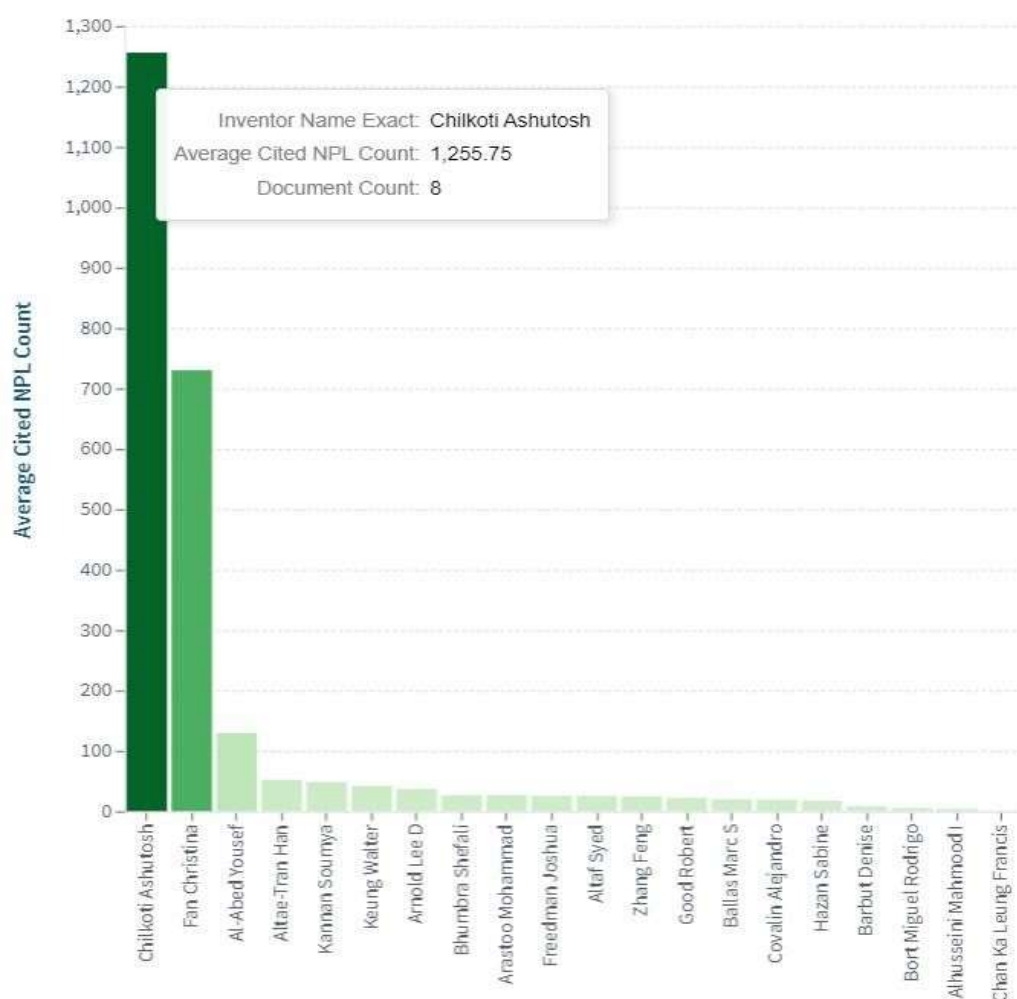
**Figure 1:** The list provided showcases the top 32 authors with their countries actively promulgated commentaries on Gut Health and COVID-19. It is worth noting that each country has published a minimum of 5 documents on the subject. The collective network graph displayed in the figure is continuous, with no isolated points. The nodes within the graph are categorized into four grouping based on their respective color. Authors within the same grouping exhibit close cooperation with one another.



**Figure 2:** Represents pertinent countries by number of commentaries in COVID-19 and gut health research in the year between January 2020– December 2023. Notably United states of America have published a greater number of documents (662) published compared to other countries. Italy and Korea have least contribution towards publishing documents on Gut Health and Covid 19.



**Figure 3:** Our comprehensive literature search yielded a total of 125 articles for initial screening (Fig 2). It is value remarking that twenty-three explorations were unpublished, while twelve studies only had abstracts available. The majority of these studies were conducted in USA and all of them focused on visceral microbiota in Covid 19 pandemic. Notably, there were no studies available on the direct relationship between Covid 19 and gut microbiota.



**Figure 4:** The term citation in this study pertains to the quotation that are cited together in another publication. The article authored by Chilkoti et al. stood out as the top-ranked publication with the highest number of NPL count 1255. The author's objective was to interrogate the alterations in gut microbiota in patients with COVID-19 followed by Fan Christina et al al with Average cited NPL count = 730, they reviewed on Gastrointestinal symptoms associated with COVID-19: impingement on the gut microbiome. Taufer et al has least number of citations for reviewing the Role of Bifidobacterium in COVID-19

**Table 1.** Most applicable authors by number of citations in COVID-19 and Gut Health Research.

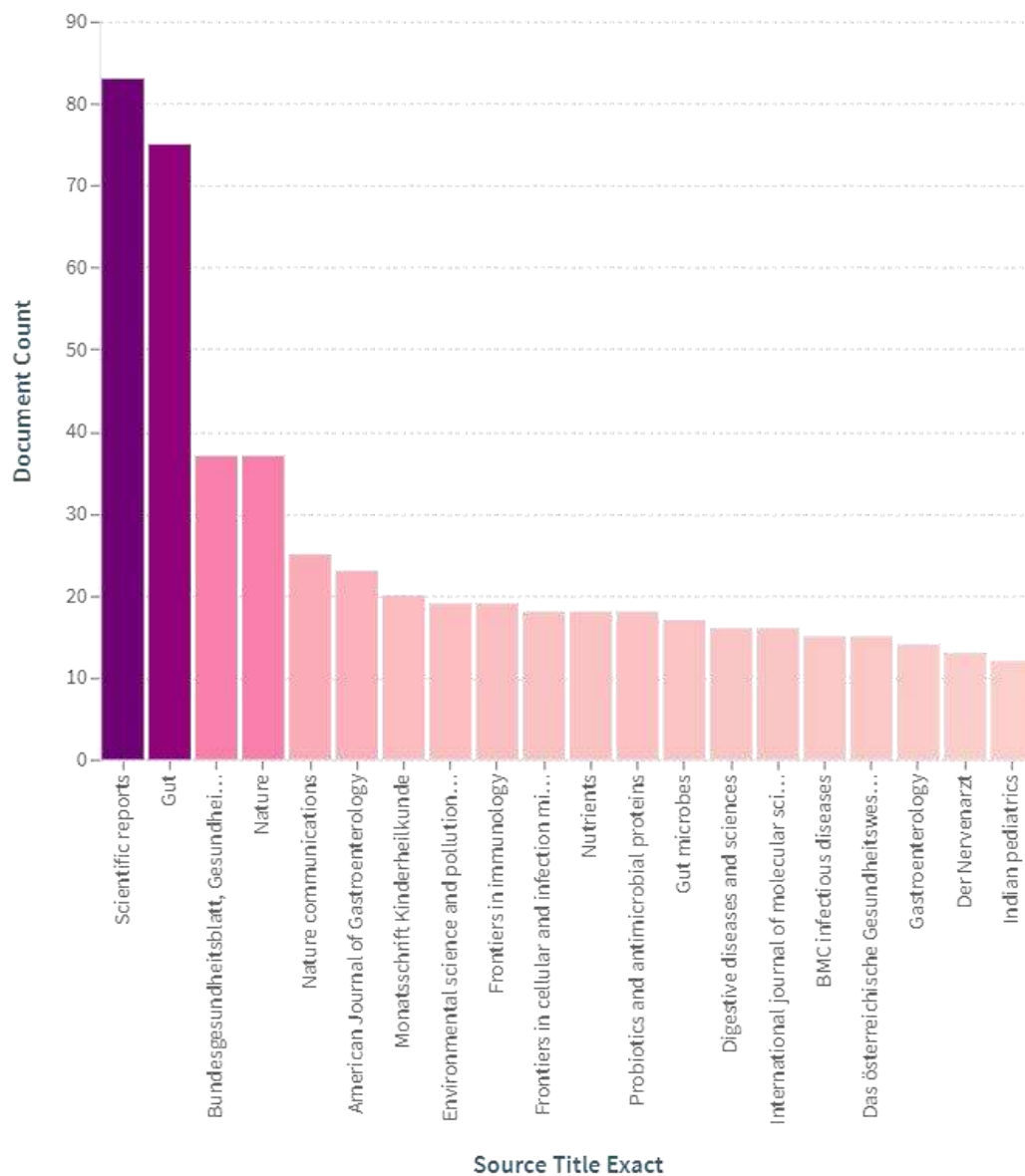
Author	No. of citations	Title
<b>Chilkoti</b>	1075	Alterations in Gut Microbiota of Patients With COVID-19 During Time of Hospitalization
<b>Fan Christina</b>	258	Gastrointestinal symptoms associated with COVID-19: impact on the gut microbiome
<b>Al- Abend Yousef</b>	128	Altered oral and gut microbiota and its association with SARS-CoV-2 viral load in COVID-19 patients during hospitalization

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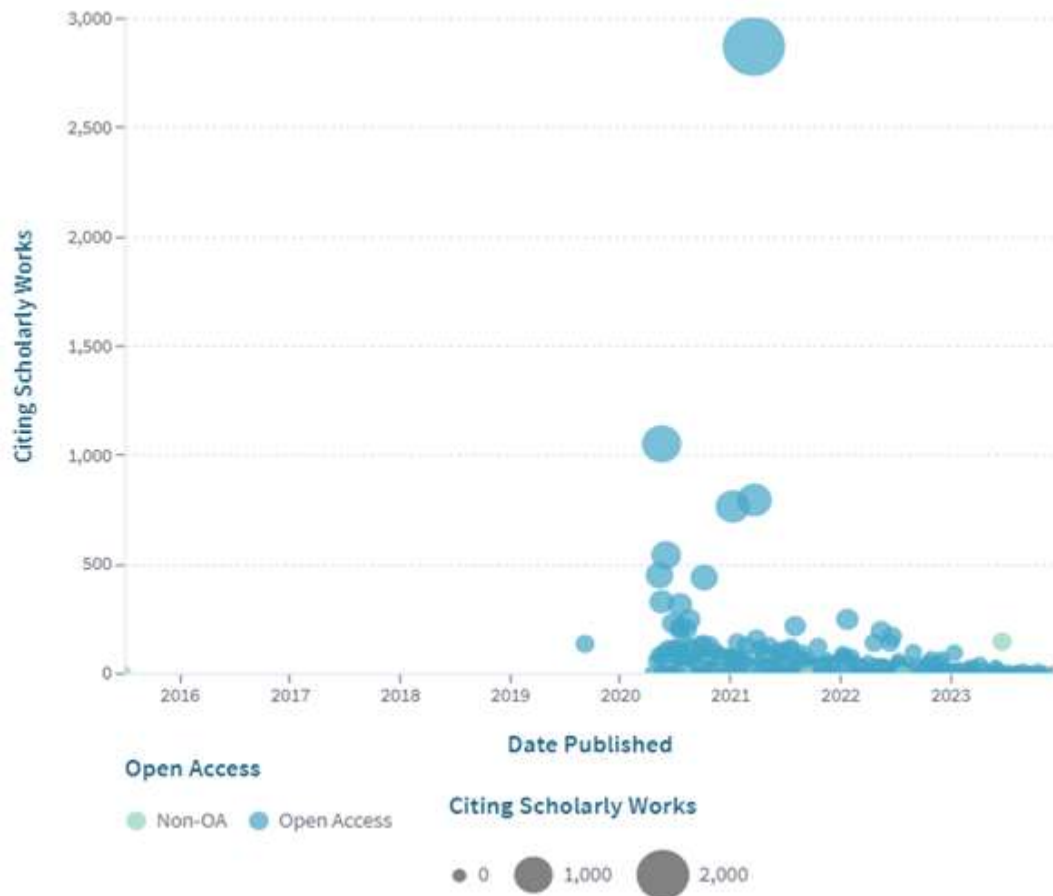
<b>Altae-Tran Han</b>	122	Role of probiotics to combat viral infections with emphasis on COVID-19
<b>Kannan Soumya</b>	113	Analysis of the intestinal microbiota in COVID-19 patients and its correlation with the inflammatory factor IL-18
<b>Keung walter</b>	109	Plasma Markers of Disrupted Gut Permeability in Severe COVID-19 Patients
<b>Arnold Lee D</b>	83	Diet, Gut Microbiota and COVID-19
<b>Bhumbra shefali</b>	72	Effects of Intestinal Fungi and Viruses on Immune Responses and Inflammatory Bowel Diseases
<b>Arastoo Mohammad</b>	66	Potential contribution of beneficial microbes to face the COVID-19 pandemic
<b>Freedman Joshua</b>	64	Gut mycobiota alterations in patients with COVID-19 and H1N1 infections and their associations with clinical features

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**Figure 5:** Unveils the most relevant journals in COVID-19 and gut health research. Journal of Scientific reports has the most documents (n = 83) and Journal of Indian Paediatrics has least number of documents (n = 12)



**Figure 6:** Shows number of open accession and non-open access journals. Among 3000 articles, 2000 were open access journals published in the year 2021.

### Discussion:

COVID-19 has been the focus of global medical research since the first weeks of the contagion. A comprehensive probe of the Web of Sciences database identified a total of 135 studies published between 2020 and 2023 on the impingement of Covid 19 on gut health. However, the understanding of the fundamental mechanisms of COVID-19 causing intestinal disorders via the gut-lung axis is still incomplete. There is still significant potential for disquisition and progress in these localities of research [24]. The extremely exemplified cross-reference is considered the most influential editorial in their respective fields. Zuo, Tao et al. stood out as the top most publication with the highest number of citations of 1075. In their pilot study of 15 cases with COVID-19, they highlighted those victims diagnosed with COVID-19 showed eloquent changes in their faecal microbiomes analogized to a control group. These changes were particularized by an augment in opportunistic pathogens and a ddownsize in beneficial commensals. These changes were observed both after hospitalization and throughout hospitalization. Even after the unveiling of SARS-CoV-2 and the resolution of respiratory manifestations, symbiont depletion and intestinal dysbiosis persisted [25]. The callousness of COVID-19 was found to supplement with the baseline abundance of Coprobacillus, Clostridium ramosum, and Clostridium hathewayi, while an antipode association was observed between the abundance of Faecalibacterium prausnitzii and disease rigidness [26]. During rehabilitation, Bacteroides dorei, Bacteroides thetaiotaomicron, Bacteroides massiliensis, and Bacteroides ovatus, which downsize the articulation of angiotensin-converting enzyme 2 (ACE2) in the mouse intestine, showed an antipode agreement with the SARS-CoV-2 load in the stool prototypes from patients [27,28].

Investigations of gut microflora changes in patients with COVID-19 have provided insight into the occurrence of dysbiosis, specified by a lessened microbial diversity, and its potential collaboration with disease sternness [29]. The pursuit of the gut microbiota in tuning the immune response and its collision on systemic inflammation highlights its importance in the pathogenesis of COVID-19 [30]. It is monumental to note that treatment for COVID-19 can have a reminiscent impingement on gut microbiota. The use of antibiotics and antiviral agents has been found to undoubtedly disrupt the microbial balance, which can imminently exacerbate dysbiosis. A study by Lucie et al. in 2022 reported that patients with COVID-19 who received antibiotics showed a higher degree of dysbiosis equated to those who did not, intimating the stipulate for careful supervision of antimicrobials to alleviate conceivable inimical effects on the gut microbiota. Yeoh and colleagues also conformed equulence between solitary gut microbial taxa and inflammatory markers such as C-reactive protein (CRP) and proinflammatory cytokines [31]. The second most cited article was by Fan Christina et al, who highlighted that changes in gut microbes and the rise of inflammatory cytokines are triggered by gut dysfunction. Therefore, it is essential to consider the diagnosis of gastrointestinal symptoms that antedate respiratory problems in COVID-19 to upgrade early discovery and treatment [33]. Analysis of the composition of the microbiota and its metabolic products in the contexture of COVID-19 can help in the identification of new biomarkers of the disease and the discovery of potential therapeutic targets. Examining changes in the microbiome as reliable biomarkers in the contexture of COVID-19 represents one aspect of the disease puzzle that has been neglected and warrants further investigation [32].

The fourth most cited article was by Altae et al entitled *The Role of Probiotics in Combating Viral Infections with an accentuation on COVID-19*. This article highlights that the treatment of COVID-19 involves investigating the preventive and supportive therapeutic effects of probiotics. Moreover, the unique ability of probiotics to modulate the intestinal microbiome, maintain intestinal homeostasis and stimulate interferon production as an antiviral mechanism is elucidated. In addition, the regulatory task of probiotics on the gut-lung axis and the mucosal immune system and their potential antiviral mechanisms are thoroughly explored and stirred up. Keystones include the key role of the gut microbiota in fighting viral diseases together with the various factors that influence the antiviral mechanism [33]. Finally, the specific relevance of probiotics in the context of COVID-19 is explored. The fifth most cited article is Kannan et al et al, who conducted a study on the modification of gut microflora in individuals affected by COVID-19. We further investigated the relationship between modified microbes and rankings of the intestinal inflammatory cytokine IL-18, which was found to be higher in the blood of patients with COVID-19. Compared to both healthy individuals and those with seasonal influenza, patients with COVID-19 showed a evocative downsize in the diversity of their gut microbiota along with an increase in opportunistic pathogens [34]. The sixth most cited article by Keung et al. on "Plasma Markers of Impaired Intestinal Permeability in Patients with stiff COVID-19 Disease", used a multi-omics systems biology approach to examine plasma prototypes from COVID-19 victims exhibiting different rankings of disease unyielding as well as SARS-CoV-2 negative controls and scanned purported associations between plasma markers related to gut barrier integrity, microbial translocation, systemic inflammation, metabolome, lipidome, and glycome and severity of COVID-19 [35]. Their findings suggest that severe cases of COVID-19 are associated with elevated strata of markers associated with tight junction permeability and translocation of bacterial and fungal products into the bloodstream. These markers, which indicate disruption of gut barrier integrity and microbial translocation, are vigorously correlated with advanced levels of markers related to systemic inflammation and immune activation, primitive levels of markers related to gut function, disrupted plasma metabolome and glycome, and increased mortality. In our study, *Journal of Scientific reports* has the most papers (n = 83) and *Journal of Indian Paediatrics* has the least papers (n = 12). These findings are fairly

consistent with antecedent bibliometric research on COVID-19 not discriminating between individual scientific domains [31-35]. As for varied scientific fields, the results unmask the following. For the life sciences, due to the tough imbrication with health sciences, the extremely pertinent journal is also the Journal of Medical Virology with the uttermost number of documents (n = 293), superseded by Psychiatry Research (n = 130), Journal of Clinical Virology (n = 120), Brain, behaviour and immunity (n = 77) and Pharmacological research (n = 63). In physical sciences, the immensely peculiar journals are Science of the Total Environment (n = 174), superceded by International Journal of Environmental Research (n = 155), Chaos, Solitons and Fractals (n = 97), Journal of Diabetes Science and Technology (n = 47) and International Journal of Advanced Science and Technology (n = 41). Our study sheds light on an often-overlooked factor that has important clinical implications: intestinal dysfunction that can potentially furnish to the severity of COVID-19 disease [36].

### Limitations

The analytical software VOS viewer has unspecified confines in this study. Their capabilities are bounded to the analysis of data engendering from databases outside of WoS and are primarily proficient for examining documentaries written in English. To excite an encyclopaedic of the research environment within this cluster, further analysis of a significant number of explorations from non- dominant nodes is necessary. These procurators may lead to controversies between the research precipitates and the actual status. Accordingly, it is crucial in future research endeavours to stay alert to the ultimate exploration and literature from other databases to derive the direction and trends in the field.

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### Conclusion

To summarize, this study represents an initial bibliometric analysis conducted to interrogate the impingement of COVID-19 on gut health. Among the countries actively contributing to gut health and COVID-19 research, the US ranks first. When it comes to journals in this field, Journal of Scientific reports have shown the highest productivity. The findings of this bibliometric analysis highlight that the most significant research topics revolve around Gastrointestinal symptoms associated with COVID-19: the impact on the gut microbiome. The emergence of these important topics related to gut health and COVID-19 can help researchers identify new research. areas in this domain.

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