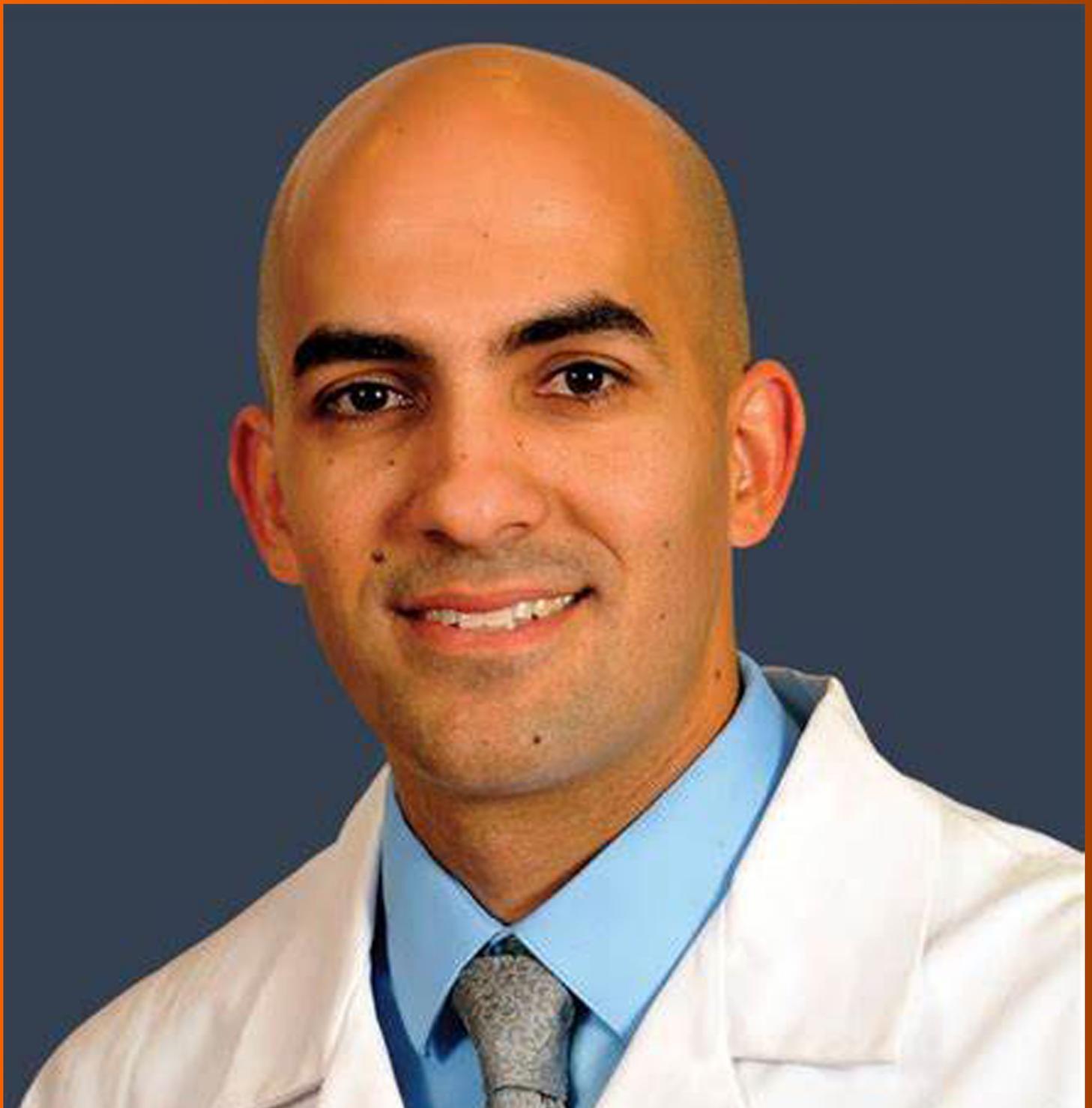


# World Journal of *Gastroenterology*

*World J Gastroenterol* 2023 July 21; 29(27): 4222-4367



**REVIEW**

- 4222 Rare causes of acute non-variceal upper gastrointestinal bleeding: A comprehensive review  
*Martino A, Di Serafino M, Orsini L, Giurazza F, Fiorentino R, Crolla E, Campione S, Molino C, Romano L, Lombardi G*
- 4236 Sarcopenia in cirrhosis: Prospects for therapy targeted to gut microbiota  
*Maslennikov R, Alieva A, Poluektova E, Zharikov Y, Suslov A, Letyagina Y, Vasileva E, Levshina A, Kozlov E, Ivashkin V*
- 4252 Bile acids and their receptors: Potential therapeutic targets in inflammatory bowel disease  
*Long XQ, Liu MZ, Liu ZH, Xia LZ, Lu SP, Xu XP, Wu MH*
- 4271 Serum resistin and the risk for hepatocellular carcinoma in diabetic patients  
*Abdalla MMI*

**ORIGINAL ARTICLE****Basic Study**

- 4289 Stomach perforation-induced general occlusion/occlusion-like syndrome and stable gastric pentadecapeptide BPC 157 therapy effect  
*Kalogjera L, Krezic I, Smoday IM, Vranes H, Zizek H, Yago H, Oroz K, Vukovic V, Kavelj I, Novosel L, Zubcic S, Barisic I, Beketic Oreskovic L, Strbe S, Sever M, Sjekavica I, Skrtic A, Boban Blagaic A, Seiwert S, Sikiric P*
- 4317 18 $\beta$ -glycyrrhetic acid promotes gastric cancer cell autophagy and inhibits proliferation by regulating miR-328-3p/signal transducer and activator of transcription 3  
*Yang Y, Nan Y, Du YH, Huang SC, Lu DD, Zhang JF, Li X, Chen Y, Zhang L, Yuan L*

**Observational Study**

- 4334 Azathioprine monotherapy withdrawal in inflammatory bowel diseases: A retrospective mono-centric study  
*Crepaldi M, Maniero D, Massano A, Pavanato M, Barberio B, Savarino EV, Zingone F*
- 4344 Predicting portal venous anomalies by left-sided gallbladder or right-sided ligamentum teres hepatis: A large scale, propensity score-matched study  
*Lin HY, Lee RC, Chai JW, Hsu CY, Chou Y, Hwang HE, Liu CA, Chiu NC, Yen HH*

**SCIENTOMETRICS**

- 4356 Research landscape on COVID-19 and liver dysfunction: A bibliometric analysis  
*Zyoud SH*

**ABOUT COVER**

Editorial Board Member of *World Journal of Gastroenterology*, Mark C Mattar, AGAF, FACG, MD, Professor of Medicine, Department of Gastroenterology, MedStar Georgetown University Hospital, Washington, DC 20007, United States. mark.c.mattar@medstar.net

**AIMS AND SCOPE**

The primary aim of *World Journal of Gastroenterology* (WJG, *World J Gastroenterol*) is to provide scholars and readers from various fields of gastroenterology and hepatology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online. WJG mainly publishes articles reporting research results and findings obtained in the field of gastroenterology and hepatology and covering a wide range of topics including gastroenterology, hepatology, gastrointestinal endoscopy, gastrointestinal surgery, gastrointestinal oncology, and pediatric gastroenterology.

**INDEXING/ABSTRACTING**

The WJG is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Current Contents/Clinical Medicine, Journal Citation Reports, Index Medicus, MEDLINE, PubMed, PubMed Central, Scopus, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 edition of Journal Citation Reports® cites the 2022 impact factor (IF) for WJG as 4.3; IF without journal self cites: 4.1; 5-year IF: 5.3; Journal Citation Indicator: 0.82; Ranking: 33 among 93 journals in gastroenterology and hepatology; and Quartile category: Q2. The WJG's CiteScore for 2021 is 8.3 and Scopus CiteScore rank 2022: Gastroenterology is 22/149.

**RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: Yi-Xuan Cai; Production Department Director: Xiang Li; Editorial Office Director: Jia-Ru Fan.

<p><b>NAME OF JOURNAL</b> <i>World Journal of Gastroenterology</i></p> <p><b>ISSN</b> ISSN 1007-9327 (print) ISSN 2219-2840 (online)</p> <p><b>LAUNCH DATE</b> October 1, 1995</p> <p><b>FREQUENCY</b> Weekly</p> <p><b>EDITORS-IN-CHIEF</b> Andrzej S Tarnawski</p> <p><b>EDITORIAL BOARD MEMBERS</b> <a href="http://www.wjgnet.com/1007-9327/editorialboard.htm">http://www.wjgnet.com/1007-9327/editorialboard.htm</a></p> <p><b>PUBLICATION DATE</b> July 21, 2023</p> <p><b>COPYRIGHT</b> © 2023 Baishideng Publishing Group Inc</p>	<p><b>INSTRUCTIONS TO AUTHORS</b> <a href="https://www.wjgnet.com/bpg/gerinfo/204">https://www.wjgnet.com/bpg/gerinfo/204</a></p> <p><b>GUIDELINES FOR ETHICS DOCUMENTS</b> <a href="https://www.wjgnet.com/bpg/GerInfo/287">https://www.wjgnet.com/bpg/GerInfo/287</a></p> <p><b>GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH</b> <a href="https://www.wjgnet.com/bpg/gerinfo/240">https://www.wjgnet.com/bpg/gerinfo/240</a></p> <p><b>PUBLICATION ETHICS</b> <a href="https://www.wjgnet.com/bpg/GerInfo/288">https://www.wjgnet.com/bpg/GerInfo/288</a></p> <p><b>PUBLICATION MISCONDUCT</b> <a href="https://www.wjgnet.com/bpg/gerinfo/208">https://www.wjgnet.com/bpg/gerinfo/208</a></p> <p><b>ARTICLE PROCESSING CHARGE</b> <a href="https://www.wjgnet.com/bpg/gerinfo/242">https://www.wjgnet.com/bpg/gerinfo/242</a></p> <p><b>STEPS FOR SUBMITTING MANUSCRIPTS</b> <a href="https://www.wjgnet.com/bpg/GerInfo/239">https://www.wjgnet.com/bpg/GerInfo/239</a></p> <p><b>ONLINE SUBMISSION</b> <a href="https://www.f6publishing.com">https://www.f6publishing.com</a></p>
--	--

## Research landscape on COVID-19 and liver dysfunction: A bibliometric analysis

Sa'ed H Zyoud

**Specialty type:** Gastroenterology and hepatology

**Provenance and peer review:** Invited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review report's scientific quality classification**

Grade A (Excellent): 0  
Grade B (Very good): B  
Grade C (Good): C  
Grade D (Fair): D  
Grade E (Poor): 0

**P-Reviewer:** Teles RHG, Brazil; Xie C, China

**Received:** February 24, 2023

**Peer-review started:** February 24, 2023

**First decision:** May 23, 2023

**Revised:** June 16, 2023

**Accepted:** June 27, 2023

**Article in press:** June 27, 2023

**Published online:** July 21, 2023



**Sa'ed H Zyoud**, Department of Clinical and Community Pharmacy, College of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine

**Sa'ed H Zyoud**, Poison Control and Drug Information Center (PCDIC), College of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine

**Sa'ed H Zyoud**, Clinical Research Centre, An-Najah National University Hospital, Nablus 44839, Palestine

**Corresponding author:** Sa'ed H Zyoud, PhD, Full Professor, Department of Clinical and Community Pharmacy, College of Medicine and Health Sciences, An-Najah National University, Academic Street, Nablus 44839, Palestine. [saedzyoud@yahoo.com](mailto:saedzyoud@yahoo.com)

### Abstract

#### BACKGROUND

The global spread of severe acute respiratory syndrome coronavirus 2, responsible for coronavirus disease 2019 (COVID-19), poses a significant risk to public health. Beyond the respiratory issues initially associated with the condition, severe cases of COVID-19 can also lead to complications in other organs, including the liver. Patients with severe COVID-19 may exhibit various clinical signs of liver dysfunction, ranging from minor elevations in liver enzymes without symptoms to more serious cases of impaired liver function. Liver damage is more commonly observed in patients with severe or critical forms of the disease.

#### AIM

To present the research landscape on COVID-19 and liver dysfunction while also offering valuable insights into the prominent areas of interest within this particular domain.

#### METHODS

On 18 February 2023, Scopus was utilised to conduct a comprehensive exploration of the relationship between COVID-19 and the liver dysfunction. The investigation encompassed the period from 1 January 2020 to 31 December 2022. Primary sources were meticulously examined and organised in a Microsoft Excel 2013 spreadsheet, categorised by journal, institution, funding agency, country and citation type. VOSviewer version 1.6.18 was employed to explore the prominent topics and knowledge network related to the subject.

## RESULTS

There were 2336 publications on COVID-19 and liver dysfunction analysed in this study, of which 558 were published in 2020, 891 in 2021 and 887 in 2022. Researchers from 111 different countries participated in the retrieved documents. The United States contributed the most studies, with 497 documents, representing 21.28% of the total, followed by China with 393 documents (16.82%) and Italy with 255 documents (10.92%). In the context of research related to COVID-19 and the liver, co-occurrence analysis identified three distinct clusters of topics: (1) 'COVID-19 vaccines in liver transplant recipients'; (2) 'liver function tests as a predictor of the severity and clinical outcomes in hospitalised patients'; and (3) 'care of patients with liver disease during the COVID-19 pandemic'.

## CONCLUSION

This bibliometric study provides a comprehensive overview of liver-related publications in COVID-19 research over the past 3 years. This study highlights the significant contributions of high-income nations, particularly the United States, China, and Italy, to the production of liver-related scholarly literature in this field. Most of the articles focused on liver dysfunction in patients with COVID-19 and the implications of the virus for gastroenterologists and hepatologists.

**Key Words:** COVID-19; Bibliometric; Scopus; Vosviewer; Liver

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

**Core Tip:** Severe cases of coronavirus disease 2019 (COVID-19) can lead to liver dysfunction, and this study provides a comprehensive overview of liver-related publications in COVID-19 research. The findings highlight the significant contributions of high-income countries, such as the United States, China, and Italy, to the production of liver-related scholarly literature in this field. The research clusters identified in the study focus on COVID-19 vaccines in liver transplant recipients, liver function tests as predictors of severity and clinical outcomes in hospitalized patients, and the care of patients with liver disease during the COVID-19 pandemic.

**Citation:** Zyoud SH. Research landscape on COVID-19 and liver dysfunction: A bibliometric analysis. *World J Gastroenterol* 2023; 29(27): 4356-4367

**URL:** <https://www.wjgnet.com/1007-9327/full/v29/i27/4356.htm>

**DOI:** <https://dx.doi.org/10.3748/wjg.v29.i27.4356>

## INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) has had a marked global impact. As of 3 May 2023, there have been over 765 million confirmed cases and nearly 6.92 million fatalities[1]. COVID-19 symptoms range from modest respiratory difficulties to severe respiratory distress syndrome, which can lead to organ failure and death. Older people with preexisting health issues are especially vulnerable. It is crucial to mention that in addition to its effects on the lungs, COVID-19 can cause liver damage[2-6]. COVID-19-related liver injury is defined as any liver damage that occurs in people who have COVID-19, regardless of whether they have a preexisting liver ailment[7-11]. Severe COVID-19 infections can cause liver damage through a variety of mechanisms, including immune-mediated damage, ischemic hepatitis caused by a systemic inflammatory response, drug-induced liver injury, reactivation of preexisting chronic liver disease, and direct cytopathic effects from the virus replicating in hepatocytes[12-15].

COVID-19-induced liver dysfunction has a variable prognosis and symptoms[16-20]. Because there is no cure for COVID-19-induced liver damage, treatment is only supportive. Preexisting liver diseases and nutritional support can help identify and treat liver disorders[21]. Research on COVID-19 and liver dysfunction is evolving, but there are not enough quantitative and visual studies based on bibliometrics. This chasm has stifled research in this field. Hence, this bibliometric analysis provides a view of the available COVID-19 and liver dysfunction research that is indexed in the Scopus database. This analysis has identified research hotspots for COVID-19 and liver dysfunction, as well as historical trends and future directions.

## MATERIALS AND METHODS

### Study design

This cross-sectional study was conducted on 18 February 2023 using a bibliometric methodology.

### **Bibliographic database**

The Scopus database was chosen as the source of data for this study for various reasons. First, Scopus stands out as the largest scientific database compared with alternatives such as Web of Science. Second, it offers convenient options for exporting and analysing data, and it is compatible with Microsoft Excel and visualisation tools such as VOSviewer. Third, Scopus is a comprehensive database that encompasses citations from diverse fields, including social and health disciplines. Consequently, Scopus emerged as the most appropriate choice for conducting the present study[22-24].

### **Search strategies**

The search was limited to publications between 1 January 2020 and 31 December 2022. The search strategy involved three steps.

In the first step, terms related to COVID-19 were selected from the Medical Subject Headings (MeSH) of PubMed and previous studies related to COVID-19[25-29]. Next, the retrieved terms were entered into the Scopus search engine as 'Article Title/Abstract' to retrieve publications related to COVID-19.

In the second step, the publications obtained in the first step were filtered to include only those with "liver and related words" in their title. Keywords relevant to the liver were selected from the previous liver and COVID-19 meta-analyses [30-34] and were entered into the Scopus engine to retrieve publications related to the liver.

In the third step, publications that were published as an erratum were excluded.

The final search query used for data extraction from Scopus looked like this: (TITLE-ABS ("COVID 19") OR TITLE-ABS ("2019 novel coronavirus") OR TITLE-ABS ("novel coronavirus") OR TITLE-ABS ("coronavirus 2019") OR TITLE-ABS ("\*novel CoV") OR TITLE-ABS ("coronavirus disease 2019") OR TITLE-ABS ("2019-novel CoV") OR TITLE-ABS ("Wuhan coronavirus") OR TITLE-ABS ("2019 ncov") OR TITLE-ABS ("Wuhan pneumonia") OR TITLE-ABS ("COVID 2019") OR TITLE-ABS (COVID19) OR TITLE-ABS (\*COVID\*) OR TITLE-ABS (nCoV) OR TITLE-ABS ("corona virus 2019") OR TITLE-ABS ("nCoV-2019") OR TITLE-ABS (nCoV2019) OR TITLE-ABS ("nCoV 2019") OR TITLE-ABS (2019-ncov) OR TITLE-ABS (COVID-19) OR TITLE-ABS ("Severe acute respiratory syndrome coronavirus 2") OR TITLE-ABS ("SARS Coronavirus 2") OR TITLE-ABS ("SARS-CoV-2") OR TITLE-ABS ("SARS-CoV 2")) AND (TITLE (liver) OR TITLE (Hepati\*) OR TITLE (aminotransferase) OR TITLE (bilirubin) OR TITLE (prothrombin) OR TITLE (ALT) OR TITLE (AST) OR TITLE (Hepato\*) OR TITLE (Cirrhosis)) AND (LIMIT-TO (PUBYEAR,2022) OR LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) ) AND (EXCLUDE (DOCTYPE,"er" ) )

During every stage of the search process, quotation marks were employed to accurately retrieve the specific phrase. Moreover, the use of asterisk truncation acted as a flexible wildcard, enabling the retrieval of any possible term.

### **Validation of the search strategy**

Limiting the search to the publication titles in the Scopus database can improve the accuracy of retrieved data by reducing the number of false positive results. By focusing the search on the title, the search algorithm will only retrieve articles with 'liver' in their titles, meaning that irrelevant articles that may mention 'liver' in their abstracts or full texts will not be retrieved. As mentioned, this approach may slightly reduce the level of sensitivity, meaning that some relevant articles that do not have a 'liver' in their titles may be missed[35,36]. This study employed a validated research approach to ensure dependable and precise findings. To minimise the risk of false positive results, every 15<sup>th</sup> document (15, 30, 45, 60, etc.) up to the end of the retrieved document list was carefully assessed by evaluating its title and abstract. The research strategy underwent continuous refinement until an entirely accurate collection of randomly selected outcomes was obtained. To confirm the absence of false-negative results or missed findings, the research productivity of 20 active authors in the field was analysed. A Spearman correlation test was utilised to compare the results derived from the research strategy with those from the authors. The study revealed a strong significant correlation ( $r = 0.953$ ,  $P < 0.001$ ) between the two sets of findings, underscoring the research strategy's high level of validity. Importantly, Sweileh WM[37, 38], and Zyoud SH[39] had previously employed this validation approach.

### **Bibliometric analysis**

The data collected included the following bibliometric parameters: the types of documents (e.g. articles, books, or conference proceedings), the year of publication, the number of publications, the citation count (which indicates how many times other works have cited the publication), the country where the publication originated, the institution or organization that produced the publication, and the journals where the publications appeared. The *Impact Index Per Article* displayed represents the top 10 most-cited papers; it is derived from the *Reference Citation Analysis* (RCA, <https://www.referencecitationanalysis.com/>) database. RCA is an open citation analysis database covering various fields and is owned by Baishideng Publishing Group Inc., situated in Pleasanton, CA 94566, United States[40-42].

### **Visualize analysis**

VOSviewer (version 1.6.18, Leiden University, Leiden, the Netherlands) was used for bibliometric visualisation[43]. In scientific research, the use of VOSviewer software for bibliometric visualisation and term co-occurrence analysis is widespread. By identifying patterns of international collaboration and analysing the co-occurrence of terms in the titles and abstracts of publications, researchers can gain insight into the hotspots in a particular field and track scientific progress[43]. Using VOSviewer software, a network of terms illustrates the relationship between terms according to the number of publications in which they appear together. This enables researchers to identify clusters of related terms that represent particular research areas or trending topics. As a result, researchers can better understand the current state of research in a particular field and identify areas for future study by identifying hotspots[44,45]. These data can be used to guide funding decisions, to identify possible collaborators and to inform policy decisions.

## RESULTS

### General characteristics of the retrieved articles

A total of 2336 publications on COVID-19 and liver dysfunction were analysed in this study. Among them, 558 were published in 2020, 891 in 2021, and 887 in 2022. Regarding the types of publications, 1438 (61.56%) were articles, 417 (17.85%) were letters, 357 (15.28%) were reviews, and 124 (5.31%) fell under other categories, such as editorials and notes.

### Top 10 active countries

Researchers from 111 different countries participated in the retrieved documents. The United States contributed the most studies, with 497 documents, representing 21.28% of the total. China followed closely behind with 393 documents, representing 16.82% of the total, and Italy came in third with 255 documents, representing 10.92% of the total publications on research related to COVID-19 and liver dysfunction. [Table 1](#) lists the top 10 active countries, which together represented 84.63% of all articles published. [Figure 1](#) is a network visualisation map showing the collaboration between countries regarding co-authorship. The minimum inclusion threshold was set at 30 documents per country; a total of 22 countries met this threshold. In the visualisation, each country is represented by a circle, and the size of the circle indicates the level of contribution the country has made in terms of co-authorship. Lines represent the links between countries, and the thickness of the line indicates the strength of collaboration between the two countries. According to the centrality measures used in the map, the United States appears to be the most central country in terms of collaborations, followed by China and Italy.

### Analysis of institutions

Eight thousand six hundred forty institutions participated in research in this field, of which the top 10 institutions represented 15.97% of all published articles. *INSERM* contributed the most articles ( $n = 26$ , 5.49%), followed by *Imperial College London* ( $n = 23$ , 4.85%) and *Sorbonne Université* ( $n = 21$ , 4.43%) ([Table 2](#)).

### Journal analysis

The top 10 most productive journals in research related to COVID-19 and the liver are shown in [Table 3](#). Approximately 19.91% of the articles were published on this list. The *Journal of Hepatology* published the most articles ( $n = 85$ , 3.64%), followed by *Liver International* ( $n = 64$ , 2.74%) and the *World Journal of Gastroenterology* ( $n = 62$ , 2.65%).

### Analysis of citations

The retrieved documents had a total of 30,766 citations, a mean of 13.17, and an  $h$ -index of 75. A total of 638 (27.3%) documents had no citations, while 55 had 100 or more citations. The top 10 articles, ranked by the number of citations, collectively received 4,758 citations. The citations for these publications varied from 283 to 1,126 in total ([Table 4](#)) [13,46-54]. Among the top 10 most-cited articles, the *Impact Index Per Article* ranged from 88.7 to 394.7.

### Term co-occurrence cluster analysis of research hotspots

In the context of COVID-19 and liver research, co-occurrence analysis was used to identify the most commonly used terms in the titles and abstracts of the relevant articles. In this case, VOSviewer was used to create a bubble map, which represents each term as a bubble, and the bubble size indicates the frequency of occurrence of that term. The analysis identified 172 terms that occurred at least 50 times in the titles and abstracts of the included publications ([Figure 2](#)). The bubbles are grouped into clusters based on the similarity of their co-occurrence patterns. There are three different groups: (1) The blue cluster, which is named 'COVID-19 vaccines in liver transplant recipients'; (2) the red group, which is titled 'liver function tests as a predictor of COVID-19 severity and clinical outcomes of COVID-19 in hospitalised patients'; and (3) the green group, which is titled 'care of patients with liver disease during the COVID-19 pandemic'.

## DISCUSSION

The correlation between liver injury and COVID-19 is associated with the severity and mortality of the disease. These findings strongly indicate a relationship between liver injury and COVID-19. Despite the observation that severe and fatal cases of the disease primarily affect older adults with liver injury, the specific underlying mechanisms remain unclear[55].

The findings indicate that the United States, China and Italy have been actively involved in COVID-19 and liver dysfunction research and have produced many publications on the subject. Numerous studies on the productivity of COVID-19 research in various fields[56-60], as measured by publications, have found that the United States, China and Italy have been the leading producers of COVID-19 publications. The United States and China have dominated research output in numerous fields, including the health sciences[61,62]. According to a report released by Japan's Science and Technology Ministry, China has emerged as the global frontrunner in scientific research output, surpassing the United States in both overall volume and the number of impactful studies. The report, published by Japan's National Institute of Science and Technology Policy, revealed that China now leads the world in annual scientific research paper publications, followed by the United States and Germany[63]. There are several factors that contribute to both the United States and China being leaders in scientific research. These factors include the size of their economies, the significant amount of money invested in research and development, and the large number of researchers working across various fields[64,65]. Notably, both countries have allocated significant funds to healthcare and biotechnology[61,65-67], ensuring that

**Table 1 The top 10 countries contributing to research related to coronavirus disease 2019 and liver**

Ranking	Country	No. of documents	%
1 <sup>st</sup>	United States	497	21.28
2 <sup>nd</sup>	China	393	16.82
3 <sup>rd</sup>	Italy	255	10.92
4 <sup>th</sup>	India	185	7.92
5 <sup>th</sup>	United Kingdom	170	7.28
6 <sup>th</sup>	Spain	125	5.35
7 <sup>th</sup>	Germany	107	4.58
8 <sup>th</sup>	Iran	97	4.15
9 <sup>th</sup>	France	74	3.17
9 <sup>th</sup>	Turkey	74	3.17

**Table 2 The top 10 institutions contributing to research related to coronavirus disease 2019 and liver**

Ranking	Institute	Country	No. of documents	%
1 <sup>st</sup>	Huazhong University of Science and Technology	China	55	2.35
2 <sup>nd</sup>	Tongji Medical College	China	53	2.27
3 <sup>rd</sup>	Centro de Investigación Biomédica en Red de Enfermedades Hepáticas y Digestivas	Spain	48	2.05
4 <sup>th</sup>	INSERM	France	36	1.54
4 <sup>th</sup>	University of Pennsylvania	United States	36	1.54
6 <sup>th</sup>	Yale School of Medicine	United States	31	1.33
7 <sup>th</sup>	Hospital Clinic Barcelona	Spain	30	1.28
8 <sup>th</sup>	AP-HP Assistance Publique - Hopitaux de Paris	France	29	1.24
8 <sup>th</sup>	Zhejiang University School of Medicine	China	29	1.24
10 <sup>th</sup>	Universitat de Barcelona	Spain	26	1.11

**Table 3 Top 10 active journals publishing research related to coronavirus disease 2019 and liver**

Ranking	Journal/source title	No. of documents	%	IF <sup>1</sup>
1 <sup>st</sup>	<i>Journal of Hepatology</i>	85	3.64	30.083
2 <sup>nd</sup>	<i>Liver International</i>	64	2.74	8.754
3 <sup>rd</sup>	<i>World Journal of Gastroenterology</i>	62	2.65	5.374
4 <sup>th</sup>	<i>Hepatology</i>	50	2.14	17.298
5 <sup>th</sup>	<i>Hepatology Communications</i>	37	1.58	5.701
6 <sup>th</sup>	<i>Clinical Gastroenterology and Hepatology</i>	36	1.54	13.576
7 <sup>th</sup>	<i>Liver Transplantation</i>	34	1.46	6.112
7 <sup>th</sup>	<i>World Journal of Hepatology</i>	34	1.46	NA
9 <sup>th</sup>	<i>World Journal of Clinical Cases</i>	32	1.37	1.534
10 <sup>th</sup>	<i>Journal of Clinical and Experimental Hepatology</i>	31	1.33	NA

<sup>1</sup>Impact factors were retrieved from the 2021 Journal Citation Reports (Clarivate Analytics).

Table 4 Top 10 articles on total citations for research related to coronavirus disease 2019 and liver from 2020 to 2022

Ranking	Ref.	Title	Year	Source title	Cited by	Impact index per article <sup>1</sup>
1 <sup>st</sup>	Zhang <i>et al</i> [13]	Liver injury in COVID-19: Management and challenges	2020	<i>The Lancet Gastroenterology and Hepatology</i>	1126	394.7
2 <sup>nd</sup>	Mao <i>et al</i> [51]	Manifestations and prognosis of gastrointestinal and liver involvement in patients with COVID-19: A systematic review and meta-analysis	2020	<i>The Lancet Gastroenterology and Hepatology</i>	549	181
3 <sup>rd</sup>	Cai <i>et al</i> [48]	COVID-19: Abnormal liver function tests	2020	<i>Journal of Hepatology</i>	542	177
4 <sup>th</sup>	Xu <i>et al</i> [53]	Liver injury during highly pathogenic human coronavirus infections	2020	<i>Liver International</i>	522	186
5 <sup>th</sup>	Fan <i>et al</i> [49]	Clinical Features of COVID-19-Related Liver Functional Abnormality	2020	<i>Clinical Gastroenterology and Hepatology</i>	460	156.7
6 <sup>th</sup>	Wang <i>et al</i> [52]	SARS-CoV-2 infection of the liver directly contributes to hepatic impairment in patients with COVID-19	2020	<i>Journal of Hepatology</i>	347	117.7
7 <sup>th</sup>	Boettler <i>et al</i> [47]	Care of patients with liver disease during the COVID-19 pandemic: EASL-ESCMID position paper	2020	<i>JHEP Reports</i>	326	88.7
8 <sup>th</sup>	Ji <i>et al</i> [50]	Nonalcoholic fatty liver diseases in patients with COVID-19: A retrospective study	2020	<i>Journal of Hepatology</i>	314	112
9 <sup>th</sup>	Zhang <i>et al</i> [54]	Liver impairment in COVID-19 patients: A retrospective analysis of 115 cases from a single center in Wuhan city, China	2020	<i>Liver International</i>	289	97.7
10 <sup>th</sup>	Bangash <i>et al</i> [46]	COVID-19 and the liver: Little cause for concern	2020	<i>The Lancet Gastroenterology and Hepatology</i>	283	90.7

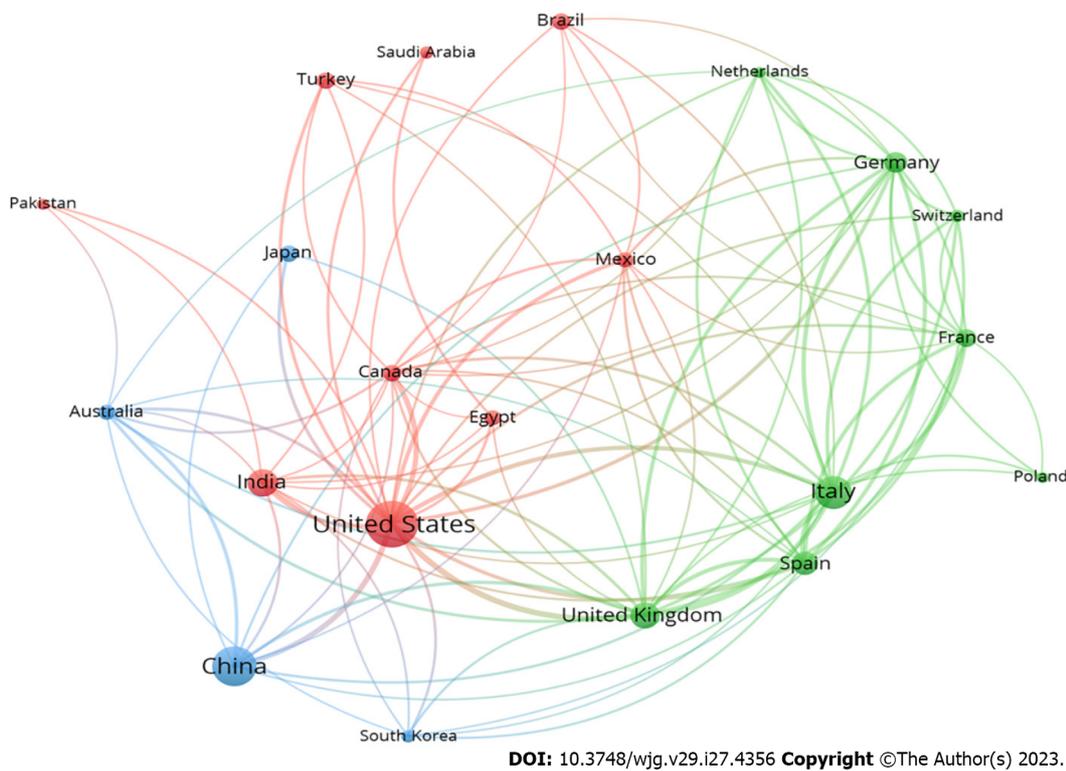
<sup>1</sup>The Impact Index Per Article is presented based on Reference Citation Analysis (Source: Baishideng Publishing Group Inc. Pleasanton, CA 94566, United States). COVID-19: Coronavirus disease 2019.

researchers have the resources they need to conduct thorough studies that yield reliable results. Furthermore, both countries have large and diverse scientific communities that encourage interdisciplinary research and expert collaboration. Funding also plays a pivotal role in driving research output, as researchers studying COVID-19 and liver dysfunction in both countries can seek substantial grants. These grants provide the necessary resources to pursue ambitious research projects, and thus attract top talent, and address critical health issues. Notable organizations such as the National Natural Science Foundation of China[68-70], the National Institutes of Health[71,72], and Gilead Sciences[47, 73] offer sizable grants for researchers studying COVID-19 and liver dysfunction in the United States and China.

One of the key hotspots in the current study is 'COVID-19 vaccines in liver transplant recipients'. Solid organ transplant recipients face a significant risk of death from COVID-19, with mortality rates ranging from 13% to 39%[74, 75]. As a result, many countries have given priority to vaccinating this vulnerable group using messenger RNA (mRNA) vaccines. Nonetheless, there is limited information available regarding their response to vaccination and its effectiveness [76]. It is critical that liver transplant recipients receive the COVID-19 vaccine to avoid hospitalisation and serious illness. COVID-19 vaccines are safe and effective in people who have had liver transplants. It should be noted, however, that these vaccines may not elicit as strong an immune response as in healthy individuals[77]. As a result, liver transplant recipients should consult their health care providers about the best time to get vaccinated, considering their specific immunosuppression regimens and recent transplant surgeries[78]. Patients who have had a liver transplant should talk to their doctors about whether they need more vaccine doses or a different vaccine to maximise their immune response[79].

'Liver function tests as a predictor of COVID-19 severity and clinical outcomes in hospitalised patients' is another study topic. Liver function tests (LFTs) are regularly conducted in hospitalised patients with COVID-19 to assess disease severity and the likelihood of poor clinical outcomes[80]. COVID-19 causes liver inflammation and abnormal LFT results [81]. In 2022, the *World Journal of Gastroenterology* reported that abnormal levels of aspartate aminotransferase (AST) and total bilirubin (T-Bil) are associated with higher mortality rates than other liver damage indicators during hospitalisation. Vasopressor medications and mechanical ventilation are linked to abnormal AST, T-Bil, and alkaline phosphatase (ALP) levels. Thus, patients with COVID-19 often have abnormal LFT results upon hospital admission, which can predict their severity and prognosis. Health care practitioners can assess risk and predict the need for advanced treatment for these individuals by measuring alanine transaminase (ALT), AST, ALP and T-Bil[82]. Patients with COVID-19 and abnormal LFT results may also have prior liver disease, medication toxicity or bacterial or viral coinfection. Thus, LFT results should be included with other clinical and laboratory data when predicting severity and clinical outcomes[83,84].

The treatment of liver disease has become increasingly important during the COVID-19 pandemic. Individuals with liver disease are more vulnerable to COVID-19-related severe illness and mortality due to factors such as a compromised immune system, advanced age and underlying health conditions[85]. Given this scenario, patients must carefully prioritise pandemic preparedness measures. Any deviation from their treatment plan - missed appointments or delayed therapy - can aggravate their liver disease and increase their COVID-19 risks[86]. Therefore, individuals with liver



**Figure 1 Network visualization map of country collaboration.** A minimum of 30 documents per country was set as a threshold, and 22 countries met the threshold. Countries can be represented as nodes in a network visualization made with VOSviewer, and lines can be created between the nodes to show correlations between co-occurrences. The strength of the co-occurrence link between the countries can be determined by the line's thickness or weight. Thicker lines are frequently used to depict stronger links.

disease should take COVID-19 precautions such as frequent and thorough handwashing, avoid large crowds and wear face masks[87]. Adopting a healthy lifestyle is also important for strengthening their immune systems and preventing COVID-19 complications. This includes regular exercise, a balanced diet, abstaining from alcohol and smoking, and getting enough sleep[88,89].

### Strengths and limitations

Although this is the first bibliometric analysis to assess the worldwide research output in the field of COVID-19 and liver dysfunction, according to previous similar studies, this study had several limitations, and it is essential to acknowledge them to ensure transparency and to promote further research in the field. First, Scopus is a widely used database for bibliometric analyses, and its coverage of peer-reviewed literature is generally comprehensive. However, the bibliometric analysis may not capture all the relevant COVID-19 and liver research publications because not all journals are indexed in Scopus, and some of the relevant publications may have been published in non-indexed or non-English-language journals. Second, searching for publications based on MeSH terms in the title is a common practice in bibliometric analysis to ensure the accuracy and relevance of the search results. However, including some publications that use related terms in other parts of the document may be a mistake. Therefore, it is recommended to use a combination of search terms, including title, abstract and keywords, to increase the sensitivity of the search. If false-negative results had occurred in the current study, they would have had little effect on the overall results. Third, the analysis may not account for the quality of the publications, as it only counts the number of publications without assessing their impact, significance or credibility. Furthermore, the ranking of publications based on total citations rather than annual citation averages could have excluded some recently published high-quality studies. However, this does not undermine the importance or contribution of these publications to the field. It is essential to note that the limitations identified in this bibliometric analysis could affect the precision and completeness of the obtained results. However, these limitations do not significantly compromise the study's validity.

## CONCLUSION

This bibliometric study provides a comprehensive overview of liver-related publications in COVID-19 research over the past 3 years. It highlights the significant contributions of high-income nations, particularly the United States, China and Italy, to the scholarly liver-related literature in this field. Most of the articles focus on liver dysfunction in patients with COVID-19 and the implications of the virus for gastroenterologists and hepatologists. Although the study acknowledges the importance of abnormal LFTs in COVID-19, it also identifies knowledge gaps regarding their pathophysiological and



COVID-19 pandemic.

### Research conclusions

The first bibliometric analysis is presented here, which is represented by the study and offers valuable insights into the research landscape on COVID-19 and liver dysfunction. Valuable reference can be derived from the findings in this field by scholars, as a comprehensive summary is provided and the frontiers of research related to COVID-19 and liver dysfunction are identified.

### Research perspectives

The goal of this study is to have current areas of focus within the field of COVID-19 and liver dysfunction identified, which can help future research be guided and clinical practice be informed. By using bibliometric analysis, a comprehensive overview of the literature on this topic is provided by the study, and the latest developments in the field can be kept up-to-date by researchers and clinicians.

---

## FOOTNOTES

**Author contributions:** Zyoud S developed the concept for the manuscript, reviewed the literature, formulated research questions, collected the data, conducted analyses and interpreted the data, and wrote the manuscript; Zyoud S read and approved the final manuscript.

**Conflict-of-interest statement:** All the authors report no relevant conflicts of interest for this article.

**PRISMA 2009 Checklist statement:** The authors have read the PRISMA 2009 Checklist, and the manuscript was prepared and revised according to the PRISMA 2009 Checklist.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

**Country/Territory of origin:** Palestine

**ORCID number:** Sa'ed H Zyoud [0000-0002-7369-2058](https://orcid.org/0000-0002-7369-2058).

**S-Editor:** Li L

**L-Editor:** A

**P-Editor:** Yu HG

---

## REFERENCES

- 1 **World Health Organization.** WHO Coronavirus (COVID-19) Dashboard. 2023. [cited 3 May 2023]. Available from: <https://covid19.who.int/>
- 2 **Guan WJ,** Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, Liu L, Shan H, Lei CL, Hui DSC, Du B, Li LJ, Zeng G, Yuen KY, Chen RC, Tang CL, Wang T, Chen PY, Xiang J, Li SY, Wang JL, Liang ZJ, Peng YX, Wei L, Liu Y, Hu YH, Peng P, Wang JM, Liu JY, Chen Z, Li G, Zheng ZJ, Qiu SQ, Luo J, Ye CJ, Zhu SY, Zhong NS; China Medical Treatment Expert Group for Covid-19. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med* 2020; **382**: 1708-1720 [PMID: [32109013](https://pubmed.ncbi.nlm.nih.gov/32109013/) DOI: [10.1056/NEJMoa2002032](https://doi.org/10.1056/NEJMoa2002032)]
- 3 **Chen G,** Wu D, Guo W, Cao Y, Huang D, Wang H, Wang T, Zhang X, Chen H, Yu H, Zhang M, Wu S, Song J, Chen T, Han M, Li S, Luo X, Zhao J, Ning Q. Clinical and immunological features of severe and moderate coronavirus disease 2019. *J Clin Invest* 2020; **130**: 2620-2629 [PMID: [32217835](https://pubmed.ncbi.nlm.nih.gov/32217835/) DOI: [10.1172/JCI137244](https://doi.org/10.1172/JCI137244)]
- 4 **Lai CC,** Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *Int J Antimicrob Agents* 2020; **55**: 105924 [PMID: [32081636](https://pubmed.ncbi.nlm.nih.gov/32081636/) DOI: [10.1016/j.ijantimicag.2020.105924](https://doi.org/10.1016/j.ijantimicag.2020.105924)]
- 5 **Verity R,** Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai N, Cuomo-Dannenburg G, Thompson H, Walker PGT, Fu H, Dighe A, Griffin JT, Baguelin M, Bhatia S, Boonyasiri A, Cori A, Cucunubá Z, FitzJohn R, Gaythorpe K, Green W, Hamlet A, Hinsley W, Laydon D, Nedjati-Gilani G, Riley S, van Elsland S, Volz E, Wang H, Wang Y, Xi X, Donnelly CA, Ghani AC, Ferguson NM. Estimates of the severity of coronavirus disease 2019: a model-based analysis. *Lancet Infect Dis* 2020; **20**: 669-677 [PMID: [32240634](https://pubmed.ncbi.nlm.nih.gov/32240634/) DOI: [10.1016/S1473-3099\(20\)30243-7](https://doi.org/10.1016/S1473-3099(20)30243-7)]
- 6 **Wang C,** Pan R, Wan X, Tan Y, Xu L, Ho CS, Ho RC. Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *Int J Environ Res Public Health* 2020; **17** [PMID: [32155789](https://pubmed.ncbi.nlm.nih.gov/32155789/) DOI: [10.3390/ijerph17051729](https://doi.org/10.3390/ijerph17051729)]
- 7 **Fu Y,** Zhu R, Bai T, Han P, He Q, Jing M, Xiong X, Zhao X, Quan R, Chen C, Zhang Y, Tao M, Yi J, Tian D, Yan W. Clinical Features of Patients Infected With Coronavirus Disease 2019 With Elevated Liver Biochemistries: A Multicenter, Retrospective Study. *Hepatology* 2021; **73**: 1509-1520 [PMID: [32602604](https://pubmed.ncbi.nlm.nih.gov/32602604/) DOI: [10.1002/hep.31446](https://doi.org/10.1002/hep.31446)]
- 8 **Hao SR,** Zhang SY, Lian JS, Jin X, Ye CY, Cai H, Zhang XL, Hu JH, Zheng L, Zhang YM, Jia HY, Yu GD, Wang XY, Gu JQ, Lu YF, Yu

- XP, Yu L, Xiang DR, Jin CL, Qiu YQ, Li LJ, Sheng JF, Liang TB, Yang YD. Liver Enzyme Elevation in Coronavirus Disease 2019: A Multicenter, Retrospective, Cross-Sectional Study. *Am J Gastroenterol* 2020; **115**: 1075-1083 [PMID: 32618658 DOI: 10.14309/ajg.0000000000000717]
- 9 **Lippi G**, de Oliveira MHS, Henry BM. Chronic liver disease is not associated with severity or mortality in Coronavirus disease 2019 (COVID-19): a pooled analysis. *Eur J Gastroenterol Hepatol* 2021; **33**: 114-115 [PMID: 32282549 DOI: 10.1097/MEG.0000000000001742]
- 10 **Musa S**. Hepatic and gastrointestinal involvement in coronavirus disease 2019 (COVID-19): What do we know till now? *Arab J Gastroenterol* 2020; **21**: 3-8 [PMID: 32253172 DOI: 10.1016/j.ajg.2020.03.002]
- 11 **Parohan M**, Yaghoubi S, Seraji A. Liver injury is associated with severe coronavirus disease 2019 (COVID-19) infection: A systematic review and meta-analysis of retrospective studies. *Hepatol Res* 2020; **50**: 924-935 [PMID: 32386449 DOI: 10.1111/hepr.13510]
- 12 **Wong YJ**, Tan M, Zheng Q, Li JW, Kumar R, Fock KM, Teo EK, Ang TL. A systematic review and meta-analysis of the COVID-19 associated liver injury. *Ann Hepatol* 2020; **19**: 627-634 [PMID: 32882393 DOI: 10.1016/j.aohep.2020.08.064]
- 13 **Zhang C**, Shi L, Wang FS. Liver injury in COVID-19: management and challenges. *Lancet Gastroenterol Hepatol* 2020; **5**: 428-430 [PMID: 32145190 DOI: 10.1016/S2468-1253(20)30057-1]
- 14 **Saha L**, Vij S, Rawat K. Liver injury induced by COVID 19 treatment - what do we know? *World J Gastroenterol* 2022; **28**: 6314-6327 [PMID: 36533104 DOI: 10.3748/wjg.v28.i45.6314]
- 15 **Naeem M**, Bano N, Manzoor S, Ahmad A, Munawar N, Razak SIA, Lee TY, Devaraj S, Hazafa A. Pathogenetic Mechanisms of Liver-Associated Injuries, Management, and Current Challenges in COVID-19 Patients. *Biomolecules* 2023; **13** [PMID: 36671484 DOI: 10.3390/biom13010099]
- 16 **Bzeizi K**, Abdulla M, Mohammed N, Alqamish J, Jamshidi N, Broering D. Effect of COVID-19 on liver abnormalities: a systematic review and meta-analysis. *Sci Rep* 2021; **11**: 10599 [PMID: 34012016 DOI: 10.1038/s41598-021-89513-9]
- 17 **Del Zompo F**, De Siena M, Ianiro G, Gasbarrini A, Pompili M, Ponziani FR. Prevalence of liver injury and correlation with clinical outcomes in patients with COVID-19: systematic review with meta-analysis. *Eur Rev Med Pharmacol Sci* 2020; **24**: 13072-13088 [PMID: 33378061 DOI: 10.26355/eurrev\_202012\_24215]
- 18 **Abdulla S**, Hussain A, Azim D, Abdullah EH, Elawamy H, Nasim S, Kumar S, Naveed H. COVID-19-Induced Hepatic Injury: A Systematic Review and Meta-Analysis. *Cureus* 2020; **12**: e10923 [PMID: 33194489 DOI: 10.7759/cureus.10923]
- 19 **Puli S**, Baig M, Walayat S. Gastrointestinal Symptoms and Elevation in Liver Enzymes in COVID-19 Infection: A Systematic Review and Meta-Analysis. *Cureus* 2020; **12**: e9999 [PMID: 32983698 DOI: 10.7759/cureus.9999]
- 20 **Shokri Afra H**, Amiri-Dashatan N, Ghorbani F, Maleki I, Rezaei-Tavirani M. Positive association between severity of COVID-19 infection and liver damage: a systematic review and meta-analysis. *Gastroenterol Hepatol Bed Bench* 2020; **13**: 292-304 [PMID: 33244371]
- 21 **Vargas-Mendoza N**, García-Machorro J, Angeles-Valencia M, Martínez-Archundia M, Madrigal-Santillán EO, Morales-González Á, Anguiano-Robledo L, Morales-González JA. Liver disorders in COVID-19, nutritional approaches and the use of phytochemicals. *World J Gastroenterol* 2021; **27**: 5630-5665 [PMID: 34629792 DOI: 10.3748/wjg.v27.i34.5630]
- 22 **Kulkarni AV**, Aziz B, Shams I, Busse JW. Comparisons of citations in Web of Science, Scopus, and Google Scholar for articles published in general medical journals. *JAMA* 2009; **302**: 1092-1096 [PMID: 19738094 DOI: 10.1001/jama.2009.1307]
- 23 **De Groote SL**, Raszewski R. Coverage of Google Scholar, Scopus, and Web of Science: a case study of the h-index in nursing. *Nurs Outlook* 2012; **60**: 391-400 [PMID: 22748758 DOI: 10.1016/j.outlook.2012.04.007]
- 24 **Powell KR**, Peterson SR. Coverage and quality: A comparison of Web of Science and Scopus databases for reporting faculty nursing publication metrics. *Nurs Outlook* 2017; **65**: 572-578 [PMID: 28377037 DOI: 10.1016/j.outlook.2017.03.004]
- 25 **Zyoud SH**, Al-Jabi SW, Shahwan MJ, Jairoun AA. Global research production pertaining to gastrointestinal involvement in COVID-19: A bibliometric and visualised study. *World J Gastrointest Surg* 2022; **14**: 494-505 [PMID: 35734615 DOI: 10.4240/wjgs.v14.i5.494]
- 26 **Zyoud SH**, Shakhshir M, Abushanab AS, Koni A, Shahwan M, Jairoun AA, Al-Jabi SW. Mapping the output of the global literature on the links between gut microbiota and COVID-19. *J Health Popul Nutr* 2023; **42**: 3 [PMID: 36653831 DOI: 10.1186/s41043-023-00346-w]
- 27 **Xavier-Santos D**, Padilha M, Fabiano GA, Vinderola G, Gomes Cruz A, Sivieri K, Costa Antunes AE. Evidences and perspectives of the use of probiotics, prebiotics, synbiotics, and postbiotics as adjuvants for prevention and treatment of COVID-19: A bibliometric analysis and systematic review. *Trends Food Sci Technol* 2022; **120**: 174-192 [PMID: 35002079 DOI: 10.1016/j.tifs.2021.12.033]
- 28 **Al-Jabi SW**. Current global research landscape on COVID-19 and depressive disorders: Bibliometric and visualization analysis. *World J Psychiatry* 2021; **11**: 253-264 [PMID: 34168972 DOI: 10.5498/wjpv.v11.i6.253]
- 29 **Tantengco OAG**. Investigating the evolution of COVID-19 research trends and collaborations in Southeast Asia: A bibliometric analysis. *Diabetes Metab Syndr* 2021; **15**: 102325 [PMID: 34739909 DOI: 10.1016/j.dsx.2021.102325]
- 30 **Cheung KS**, Mok CH, Mao X, Zhang R, Hung IF, Seto WK, Yuen MF. COVID-19 vaccine immunogenicity among chronic liver disease patients and liver transplant recipients: A meta-analysis. *Clin Mol Hepatol* 2022; **28**: 890-911 [PMID: 36263669 DOI: 10.3350/cmh.2022.0087]
- 31 **Dong X**, Zeng DY, Xing QQ, Hong MZ, Pan JS. Liver chemistries in severe or non-severe cases of COVID-19: A systematic review and meta-analysis. *World J Hepatol* 2022; **14**: 2012-2024 [PMID: 36618330 DOI: 10.4254/wjh.v14.i12.2012]
- 32 **Nagarajan R**, Krishnamoorthy Y, Rajaa S, Hariharan VS. COVID-19 Severity and Mortality Among Chronic Liver Disease Patients: A Systematic Review and Meta-Analysis. *Prev Chronic Dis* 2022; **19**: E53 [PMID: 36007255 DOI: 10.5888/pcd19.210228]
- 33 **Yang R**, Feng J, Wan H, Zeng X, Ji P, Zhang J. Liver injury associated with the severity of COVID-19: A meta-analysis. *Front Public Health* 2023; **11**: 1003352 [PMID: 36817905 DOI: 10.3389/fpubh.2023.1003352]
- 34 **Yoo JJ**, Yon DK, Lee SW, Shin JI, Kim BK. Humoral Immunogenicity to SARS-CoV-2 Vaccination in Liver Transplant Recipients: A Systematic Review and Meta-Analysis. *Int J Biol Sci* 2022; **18**: 5849-5857 [PMID: 36263175 DOI: 10.7150/ijbs.77030]
- 35 **Sweileh WM**. A bibliometric analysis of global research output on health and human rights (1900-2017). *Glob Health Res Policy* 2018; **3**: 30 [PMID: 30377667 DOI: 10.1186/s41256-018-0085-8]
- 36 **Sweileh WM**, Al-Jabi SW, Zyoud SH, Shraim NY, Anayah FMA, Sawalha AF, AbuTaha AS. Bibliometric analysis of global publications in medication adherence (1900-2017). *Int J Pharm Pract* 2019; **27**: 112-120 [PMID: 30044514 DOI: 10.1111/ijpp.12471]
- 37 **Sweileh WM**. Substandard and falsified medical products: bibliometric analysis and mapping of scientific research. *Global Health* 2021; **17**: 114 [PMID: 34556126 DOI: 10.1186/s12992-021-00766-5]
- 38 **Sweileh WM**. Global research activity on mathematical modeling of transmission and control of 23 selected infectious disease outbreak. *Global Health* 2022; **18**: 4 [PMID: 35062966 DOI: 10.1186/s12992-022-00803-x]

- 39 **Zyoud SH.** The state of current research on COVID-19 and antibiotic use: global implications for antimicrobial resistance. *J Health Popul Nutr* 2023; **42**: 42 [PMID: 37173756 DOI: 10.1186/s41043-023-00386-2]
- 40 **Wang JL,** Ma YJ, Ma L, Ma N, Guo DM, Ma LS. Baishideng's Reference Citation Analysis database announces the first Article Influence Index of multidisciplinary scholars. *World J Clin Cases* 2022; **10**: 10391-10398 [PMID: 36312463 DOI: 10.12998/wjcc.v10.i29.10391]
- 41 **Wang JL,** Ma YJ, Ma L, Ma N, Guo DM, Ma LS. Baishideng's Reference Citation Analysis database announces the first Journal Article Influence Index of 101 core journals and a list of high-quality academic journals in gastroenterology and hepatology. *World J Gastroenterol* 2022; **28**: 5383-5394 [PMID: 36312837 DOI: 10.3748/wjg.v28.i37.5383]
- 42 **Wang JL,** Ma YJ, Ma L, Ma N, Guo DM, Ma LS. Baishideng's Reference Citation Analysis database announces the first Journal Article Influence Index of 104 core journals and a list of high-quality academic journals in orthopedics. *World J Orthop* 2022; **13**: 891-902 [PMID: 36312521 DOI: 10.5312/wjo.v13.i10.891]
- 43 **van Eck NJ,** Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* 2010; **84**: 523-538 [PMID: 20585380 DOI: 10.1007/s11192-009-0146-3]
- 44 **Flis I,** van Eck NJ. Framing psychology as a discipline (1950-1999): A large-scale term co-occurrence analysis of scientific literature in psychology. *Hist Psychol* 2018; **21**: 334-362 [PMID: 28726441 DOI: 10.1037/hop0000067]
- 45 **van Eck NJ,** Waltman L. Citation-based clustering of publications using CitNetExplorer and VOSviewer. *Scientometrics* 2017; **111**: 1053-1070 [PMID: 28490825 DOI: 10.1007/s11192-017-2300-7]
- 46 **Bangash MN,** Patel J, Parekh D. COVID-19 and the liver: little cause for concern. *Lancet Gastroenterol Hepatol* 2020; **5**: 529-530 [PMID: 32203680 DOI: 10.1016/S2468-1253(20)30084-4]
- 47 **Boettler T,** Newsome PN, Mondelli MU, Maticic M, Cordero E, Cornberg M, Berg T. Care of patients with liver disease during the COVID-19 pandemic: EASL-ESCMID position paper. *JHEP Rep* 2020; **2**: 100113 [PMID: 32289115 DOI: 10.1016/j.jhepr.2020.100113]
- 48 **Cai Q,** Huang D, Yu H, Zhu Z, Xia Z, Su Y, Li Z, Zhou G, Gou J, Qu J, Sun Y, Liu Y, He Q, Chen J, Liu L, Xu L. COVID-19: Abnormal liver function tests. *J Hepatol* 2020; **73**: 566-574 [PMID: 32298767 DOI: 10.1016/j.jhep.2020.04.006]
- 49 **Fan Z,** Chen L, Li J, Cheng X, Yang J, Tian C, Zhang Y, Huang S, Liu Z, Cheng J. Clinical Features of COVID-19-Related Liver Functional Abnormality. *Clin Gastroenterol Hepatol* 2020; **18**: 1561-1566 [PMID: 32283325 DOI: 10.1016/j.cgh.2020.04.002]
- 50 **Ji D,** Qin E, Xu J, Zhang D, Cheng G, Wang Y, Lau G. Non-alcoholic fatty liver diseases in patients with COVID-19: A retrospective study. *J Hepatol* 2020; **73**: 451-453 [PMID: 32278005 DOI: 10.1016/j.jhep.2020.03.044]
- 51 **Mao R,** Qiu Y, He JS, Tan JY, Li XH, Liang J, Shen J, Zhu LR, Chen Y, Iacucci M, Ng SC, Ghosh S, Chen MH. Manifestations and prognosis of gastrointestinal and liver involvement in patients with COVID-19: a systematic review and meta-analysis. *Lancet Gastroenterol Hepatol* 2020; **5**: 667-678 [PMID: 32405603 DOI: 10.1016/S2468-1253(20)30126-6]
- 52 **Wang Y,** Liu S, Liu H, Li W, Lin F, Jiang L, Li X, Xu P, Zhang L, Zhao L, Cao Y, Kang J, Yang J, Li L, Liu X, Li Y, Nie R, Mu J, Lu F, Zhao S, Lu J, Zhao J. SARS-CoV-2 infection of the liver directly contributes to hepatic impairment in patients with COVID-19. *J Hepatol* 2020; **73**: 807-816 [PMID: 32437830 DOI: 10.1016/j.jhep.2020.05.002]
- 53 **Xu L,** Liu J, Lu M, Yang D, Zheng X. Liver injury during highly pathogenic human coronavirus infections. *Liver Int* 2020; **40**: 998-1004 [PMID: 32170806 DOI: 10.1111/liv.14435]
- 54 **Zhang Y,** Zheng L, Liu L, Zhao M, Xiao J, Zhao Q. Liver impairment in COVID-19 patients: A retrospective analysis of 115 cases from a single centre in Wuhan city, China. *Liver Int* 2020; **40**: 2095-2103 [PMID: 32239796 DOI: 10.1111/liv.14455]
- 55 **Wu ZH,** Yang DL. A meta-analysis of the impact of COVID-19 on liver dysfunction. *Eur J Med Res* 2020; **25**: 54 [PMID: 33148326 DOI: 10.1186/s40001-020-00454-x]
- 56 **Zyoud SH,** Shakhshir M, Koni A, Shahwan M, Jairoun AA, Al-Jabi SW. Olfactory and Gustatory Dysfunction in COVID-19: A Global Bibliometric and Visualized Analysis. *Ann Otol Rhinol Laryngol* 2023; **132**: 164-172 [PMID: 35240864 DOI: 10.1177/00034894221082735]
- 57 **Doskaliuk B,** Yatsyshyn R, Klisich I, Zimba O. COVID-19 from a rheumatology perspective: bibliometric and altmetric analysis. *Rheumatol Int* 2021; **41**: 2091-2103 [PMID: 34596719 DOI: 10.1007/s00296-021-04987-0]
- 58 **Wei N,** Xu Y, Wang H, Jia Q, Shou X, Zhang X, Zhang N, Li Y, Zhai H, Hu Y. Bibliometric and visual analysis of cardiovascular diseases and COVID-19 research. *Front Public Health* 2022; **10**: 1022810 [PMID: 36568760 DOI: 10.3389/fpubh.2022.1022810]
- 59 **Xu SC,** Zhao XY, Xing HP, Wu W, Zhang SY. Cardiac Involvement in COVID-19: A Global Bibliometric and Visualized Analysis. *Front Cardiovasc Med* 2022; **9**: 955237 [PMID: 35966543 DOI: 10.3389/fcvm.2022.955237]
- 60 **Zhao J,** Zhu J, Huang C, Zhu X, Zhu Z, Wu Q, Yuan R. Uncovering the information immunology journals transmitted for COVID-19: A bibliometric and visualization analysis. *Front Immunol* 2022; **13**: 1035151 [PMID: 36405695 DOI: 10.3389/fimmu.2022.1035151]
- 61 **Xie Y,** Zhang C, Lai Q. China's rise as a major contributor to science and technology. *Proc Natl Acad Sci U S A* 2014; **111**: 9437-9442 [PMID: 24979796 DOI: 10.1073/pnas.1407709111]
- 62 **Li M,** Liu X, Zhang L. Health sciences journals: an overview of outputs by Chinese authors. *Health Info Libr J* 2015; **32**: 255-264 [PMID: 26123736 DOI: 10.1111/hir.12112]
- 63 **The Guardian.** China overtakes the US in scientific research output. 2022. [Cited 10 June 2023] Available from: <https://www.theguardian.com/world/2022/aug/11/china-overtakes-the-us-in-scientific-research-output>
- 64 **Optimizing the Nation's Investment in Academic Research: A New Regulatory Framework for the 21st Century.** Washington (DC): National Academies Press (US); 2016-Jul-27 [PMID: 27386613]
- 65 **Momtazmanesh S,** Saghazadeh A, Becerra JCA, Aramesh K, Barba FJ, Bella F, Blakney A, Capaccioli M, Castagna R, Crisanti U, Davtyan T, Dorigo T, Ealy J, Farokhnia M, Grancini G, Gupta M, Harbi A, Krysztofiak W, Kulasinghe A, Lam CM, Leemans A, Lighthill B, Limongelli V, Lopreiato P, Luongo L, Maboloc CR, Malekzadeh R, Gomes OC, Milosevic M, Nouwen J, Ortega-Sánchez D, Pawelek J, Pramanik S, Ramakrishna S, Renn O, Sanseviero S, Sauter D, Schreiber M, Sellke FW, Shahbazi MA, Shelkovaya N, Slater WH, Snoeck D, Sztajer S, Uddin LQ, Veramendi-Espinoza L, Vinuesa R, Willett WC, Wu D, Żyniewicz K, Rezaei N. International Scientific Collaboration Is Needed to Bridge Science to Society: USERN2020 Consensus Statement. *SN Compr Clin Med* 2021; **3**: 1699-1703 [PMID: 33997623 DOI: 10.1007/s42399-021-00896-2]
- 66 **Xie Q,** Freeman RB. Bigger Than You Thought: China's Contribution to Scientific Publications and Its Impact on the Global Economy. *China & World Economy* 2019; **27**: 1-27 [DOI: 10.1111/cwe.12265]
- 67 **Kwiek M.** Internationalists and locals: international research collaboration in a resource-poor system. *Scientometrics* 2020; **124**: 57-105 [DOI: 10.1007/s11192-020-03460-2]
- 68 **Feng G,** Zheng KI, Yan QQ, Rios RS, Targher G, Byrne CD, Poucke SV, Liu WY, Zheng MH. COVID-19 and Liver Dysfunction: Current

- Insights and Emergent Therapeutic Strategies. *J Clin Transl Hepatol* 2020; **8**: 18-24 [PMID: 32274342 DOI: 10.14218/JCTH.2020.00018]
- 69 **Li J**, Fan JG. Characteristics and Mechanism of Liver Injury in 2019 Coronavirus Disease. *J Clin Transl Hepatol* 2020; **8**: 13-17 [PMID: 32274341 DOI: 10.14218/JCTH.2020.00019]
- 70 **Targher G**, Mantovani A, Byrne CD, Wang XB, Yan HD, Sun QF, Pan KH, Zheng KI, Chen YP, Eslam M, George J, Zheng MH. Risk of severe illness from COVID-19 in patients with metabolic dysfunction-associated fatty liver disease and increased fibrosis scores. *Gut* 2020; **69**: 1545-1547 [PMID: 32414813 DOI: 10.1136/gutjnl-2020-321611]
- 71 **Webb GJ**, Marjot T, Cook JA, Aloman C, Armstrong MJ, Brenner EJ, Catana MA, Cargill T, Dhanasekaran R, García-Juárez I, Hagström H, Kennedy JM, Marshall A, Masson S, Mercer CJ, Perumalswami PV, Ruiz I, Thaker S, Ufere NN, Barnes E, Barritt AS 4th, Moon AM. Outcomes following SARS-CoV-2 infection in liver transplant recipients: an international registry study. *Lancet Gastroenterol Hepatol* 2020; **5**: 1008-1016 [PMID: 32866433 DOI: 10.1016/S2468-1253(20)30271-5]
- 72 **Marjot T**, Moon AM, Cook JA, Abd-Elsalam S, Aloman C, Armstrong MJ, Pose E, Brenner EJ, Cargill T, Catana MA, Dhanasekaran R, Eshraghian A, García-Juárez I, Gill US, Jones PD, Kennedy J, Marshall A, Matthews G, Mells G, Mercer C, Perumalswami PV, Avitabile E, Qi X, Su F, Ufere NN, Wong YJ, Zheng MH, Barnes E, Barritt AS 4th, Webb GJ. Outcomes following SARS-CoV-2 infection in patients with chronic liver disease: An international registry study. *J Hepatol* 2021; **74**: 567-577 [PMID: 33035628 DOI: 10.1016/j.jhep.2020.09.024]
- 73 **Zampino R**, Mele F, Florio LL, Bertolino L, Andini R, Galdo M, De Rosa R, Corcione A, Durante-Mangoni E. Liver injury in remdesivir-treated COVID-19 patients. *Hepatol Int* 2020; **14**: 881-883 [PMID: 32725454 DOI: 10.1007/s12072-020-10077-3]
- 74 **Azzi Y**, Bartash R, Scalea J, Loarte-Campos P, Akalin E. COVID-19 and Solid Organ Transplantation: A Review Article. *Transplantation* 2021; **105**: 37-55 [PMID: 33148977 DOI: 10.1097/TP.0000000000003523]
- 75 **Dumortier J**, Duvoux C, Roux O, Altieri M, Barraud H, Besch C, Caillard S, Coilly A, Conti F, Dharancy S, Durand F, Francoz C, Garaix F, Houssel-Debry P, Kounis I, Lassailly G, Laverdure N, Leroy V, Mallet M, Mazzola A, Meunier L, Radenne S, Richardet JP, Vanlemmens C, Hazzan M, Saliba F; French Solid Organ Transplant COVID Registry; Groupe de Recherche Français en Greffe de Foie (GReF<sup>2</sup>). Covid-19 in liver transplant recipients: the French SOT COVID registry. *Clin Res Hepatol Gastroenterol* 2021; **45**: 101639 [PMID: 33636654 DOI: 10.1016/j.clinre.2021.101639]
- 76 **Tu ZH**, Jin PB, Chen DY, Chen ZY, Li ZW, Wu J, Lou B, Zhang BS, Zhang L, Zhang W, Liang TB. Evaluating the Response and Safety of Inactivated COVID-19 Vaccines in Liver Transplant Recipients. *Infect Drug Resist* 2022; **15**: 2469-2474 [PMID: 35592105 DOI: 10.2147/IDR.S359919]
- 77 **Ozaka S**, Kobayashi T, Mizukami K, Murakami K. COVID-19 vaccination and liver disease. *World J Gastroenterol* 2022; **28**: 6791-6810 [PMID: 36632314 DOI: 10.3748/wjg.v28.i48.6791]
- 78 **Alqahtani SA**, Barry M, Memish Z, Hashim A, Alfares MA, Alghamdi SA, Al-Hamoudi WK, Al-Judaibi B, Alhazzani W, Al-Tawfiq JA, Abaalkhail F. Use of COVID-19 vaccines in patients with liver disease and post-liver transplantation: Position statement of the Saudi association for the study of liver diseases and transplantation. *Saudi J Gastroenterol* 2021; **27**: 201-207 [PMID: 34100388 DOI: 10.4103/sjg.sjg\_223\_21]
- 79 **Luxenburger H**, Reeg DB, Lang-Meli J, Reinscheid M, Eisner M, Bettinger D, Oberhardt V, Salimi Alizee E, Wild K, Graeser A, Karl V, Sagar, Emmerich F, Klein F, Panning M, Huzly D, Bengsch B, Boettler T, Elling R, Thimme R, Hofmann M, Neumann-Haefelin C. Boosting compromised SARS-CoV-2-specific immunity with mRNA vaccination in liver transplant recipients. *J Hepatol* 2023; **78**: 1017-1027 [PMID: 36804404 DOI: 10.1016/j.jhep.2023.02.007]
- 80 **Abdelrahman MM**, Abdel-Baset AA, Younis MA, Mahmoud MG, Shafik NS. Liver function test abnormalities in COVID-19 patients and factors affecting them - a retrospective study. *Clin Exp Hepatol* 2021; **7**: 297-304 [PMID: 34712832 DOI: 10.5114/ceh.2021.109225]
- 81 **Przekop D**, Gruszewska E, Chrostek L. Liver function in COVID-19 infection. *World J Hepatol* 2021; **13**: 1909-1918 [PMID: 35069997 DOI: 10.4254/wjh.v13.i12.1909]
- 82 **Krishnan A**, Prichett L, Tao X, Alqahtani SA, Hamilton JP, Mezey E, Strauss AT, Kim A, Potter JJ, Chen PH, Woreta TA. Abnormal liver chemistries as a predictor of COVID-19 severity and clinical outcomes in hospitalized patients. *World J Gastroenterol* 2022; **28**: 570-587 [PMID: 35316959 DOI: 10.3748/wjg.v28.i5.570]
- 83 **Sivandzadeh GR**, Askari H, Safarpour AR, Ejtehad F, Raeis-Abdollahi E, Vaez Lari A, Abazari MF, Tarkesh F, Bagheri Lankarani K. COVID-19 infection and liver injury: Clinical features, biomarkers, potential mechanisms, treatment, and management challenges. *World J Clin Cases* 2021; **9**: 6178-6200 [PMID: 34434987 DOI: 10.12998/wjcc.v9.i22.6178]
- 84 **Kayaaslan B**, Guner R. COVID-19 and the liver: A brief and core review. *World J Hepatol* 2021; **13**: 2013-2023 [PMID: 35070005 DOI: 10.4254/wjh.v13.i12.2013]
- 85 **Kariyawasam JC**, Jayarajah U, Abeysuriya V, Riza R, Seneviratne SL. Involvement of the Liver in COVID-19: A Systematic Review. *Am J Trop Med Hyg* 2022; **106**: 1026-1041 [PMID: 35203056 DOI: 10.4269/ajtmh.21-1240]
- 86 **Hu X**, Sun L, Guo Z, Wu C, Yu X, Li J. Management of COVID-19 patients with chronic liver diseases and liver transplants. *Ann Hepatol* 2022; **27**: 100653 [PMID: 34929350 DOI: 10.1016/j.aohep.2021.100653]
- 87 **Güner R**, Hasanoğlu I, Aktaş F. COVID-19: Prevention and control measures in community. *Turk J Med Sci* 2020; **50**: 571-577 [PMID: 32293835 DOI: 10.3906/sag-2004-146]
- 88 **Monye I**, Adelowo AB. Strengthening immunity through healthy lifestyle practices: Recommendations for lifestyle interventions in the management of COVID-19. *Lifestyle Medicine* 2020; **1** [DOI: 10.1002/Lim2.7]
- 89 **Veljković M**, Pavlović DR, Stojanović NM, Džopalić T, Popović Dragonjić L. Behavioral and Dietary Habits That Could Influence Both COVID-19 and Non-Communicable Civilization Disease Prevention-What Have We Learned Up to Now? *Medicina (Kaunas)* 2022; **58** [PMID: 36422225 DOI: 10.3390/medicina58111686]



Published by **Baishideng Publishing Group Inc**  
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA  
**Telephone:** +1-925-3991568  
**E-mail:** [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)  
**Help Desk:** <https://www.f6publishing.com/helpdesk>  
<https://www.wjgnet.com>

