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Global Landscape of Urban Agriculture and Covid-19 Research: A Bibliometric Analysis

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Abstract

During the Covid-19 pandemic, urban agriculture, which refers to various forms of agricultural production within or surrounding the city, gained more attention from scholars worldwide. Given the multiple benefits associated with urban agriculture, these practices were adopted to address the adverse impacts in various dimensions, such as food security, health, and well-being. Simultaneously, urban agriculture also was affected by the Covid-19 pandemic, influencing the practice from both theoretical and practical perspectives, which expanded the scope of research in this field across various disciplines and perspectives. Consequently, it is difficult to track the topic and scope of the current research status as a basis for developing research about urban agriculture in the future. However, a systematic review that consolidates the current state of knowledge to support advanced research had not yet been conducted. Our paper aimed to fill this gap by employing a bibliometric analysis of articles in the Web of Science Core Collection (WoSCC) to examine the research landscape of urban agriculture and Covid-19. VOSviewer was the main platform adopted to conduct the bibliometric analysis in order to construct the research landscape based on three scopes, namely, main contributors (authors, sources, organisations, and countries), hot issues, and research themes. The analysis revealed that the WoSCC had indexed a total of 214 articles, with an increasing number of publications from 2020 to 2022. Although studies on urban agriculture and Covid-19 were conducted worldwide, authors and organisations from developed countries, especially the United States, were the primary contributors to article publications. The journal “Sustainability” was the main source of published articles about urban agriculture and Covid-19, receiving the highest number of citations. Research on urban agriculture and Covid-19 was conducted under eight crucial research themes associated with the food sector, benefits for health and well-being, climate change and air quality, marginalised communities, practising the community garden, practising home gardening, lessons learned from the policies and projects, and innovation and technology. Despite research being conducted on urban agriculture and the Covid-19 pandemic within different themes and geographical contexts, the majority of studies primarily focused on the benefits and behaviour change associated with urban agriculture practices to mitigate the negative impact of Covid-19 in terms of the food system and mental health. This finding is consistent with the keywords co-occurrence analysis, which identified “food security/insecurity” and “resilience” as the main hot issues. In addition, most of the other high-frequency keywords also were associated with the food system and well-being. Based on these findings, research on

urban agriculture during Covid-19 generally concentrated on the crucial problems associated with Covid-19, especially for the food sector and health, rather than urbanization, which had been the primary focus in earlier times. Finally, we provide recommended ways forward for future studies in this field by offering insights into the current scope of the research landscape on urban agriculture and Covid-19, which had been neglected in previous studies.

Keywords

Bibliometric analysis; Hot issue; Research Theme; Urban Agriculture; Covid-19

1. Introduction

The Covid-19 pandemic and its preventive measures triggered extensive global economic and social impacts, affecting all sectors of the world (Kang et al., 2021; Sridhar et al., 2022). In response to the adverse effects, scholars have produced numerous studies associated with various scientific disciplines, including not only medical science but also social science, environment, engineering, management, and public administration (Hamidah et al., 2020; Roychowdhury et al., 2022). Among the various sciences and topics associated with urban planning and policies, urban agriculture has gained attention from scholars and practitioners as a solution to address and mitigate the effects of Covid-19 in urban areas (Khan et al., 2020; Sylvester et al., 2022). Urban agriculture involves the production of food and other outputs through agricultural activities and related processes within the city and surrounding areas (Food and Agriculture Organization of the United Nations [FAO], 2022). According to this definition, urban agriculture refers to all forms of agricultural production within or around the city (Wagstaff & Wortman, 2015) and usually is described in a wide range of forms, such as home gardening, community gardens, urban edible horticulture landscape, urban farming, backyard farm, greenhouse farm, hydroponic farms, amongst others (Dobele & Zvirbule, 2020; Sridhar et al., 2022).

Although urban agriculture has received more attention during Covid-19, this was not a new practice. Urban agriculture has been established since the first city emerged with food resources (Dobele & Zvirbule, 2020). Historical records show that urban agriculture usually gained attention during times of crisis (Cerda et al., 2022; Schoen et al., 2021). As with previous crises, urban agriculture during the Covid-19 pandemic has been positioned as a solution to address the negative impact of the crisis on the food sector (Nchanji & Lutomia, 2021; Paganini et al., 2020; Sridhar et al., 2022). The pandemic and associated restrictions disrupted the food supply chain (Khan et al., 2020) and created food insecurity (Houessou et al., 2021; Kimani-Murage et al., 2022) by interrupting the regular flow of food from producers to consumers, leading to increased food prices, labor supply issues, and reduced access to and availability of food (Bulgari et al., 2021; Kimani-Murage et al., 2022; Priyadarshini & Abhilash, 2021). At the same time, the lockdowns reduced income due to restrictions on movement and the decline in business (Manda, 2022), creating economic barriers to access food. Under such circumstances, urban areas inevitably face food limitations and food insecurity. Increasing food production to an adequate, safe, and sustainable level has thus become a priority during the pandemic (Sridhar et al., 2022). Urban agriculture has been resurgent, reintroduced, and discussed as a solution to add resilience to the current food system and supply chain disrupted by Covid-19 (Khan et al., 2020; Schoen et al., 2021). Not only are there benefits to the food sector, but there also is evidence that urban agriculture provided other benefits during Covid-19, such as supporting people's health and well-being (Cerda et al., 2022; Poortinga et al., 2021; Robinson et al., 2021), as well as enhancing urban biodiversity (Zhang et al., 2021). Urban agriculture

is thus a multifunctional solution to address the problems occurring during the Covid-19 pandemic. Galimberti et al. (2020) indicate that integrating biodiversity into the urban landscape in the form of urban agriculture synergises food security, ecosystem services, and human well-being. This is in line with the study of Mead et al. (2022), which indicated that home food growing in the United Kingdom during Covid-19 resulted in a lower level of food insecurity and a higher level of well-being. Due to the multifunctionality of urban agriculture, it was promoted in various cities during Covid-19 (Janowska et al., 2022; Music et al., 2022; Kimani-Murage et al., 2022).

Urban agriculture not only gained attention from practitioners aiming to respond to Covid-19, but it also captured the attention of the scholar circle who have begun to examine the practice of urban agriculture as a means to combat the pandemic. In addition, these studies analyse the impact of Covid-19 on the existing urban agriculture practice. Although urban agriculture practices previously had been adopted in response to crises and daily life before the pandemic, the scale of the Covid-19 pandemic was much greater than the previous situations and lead to a diverse range of research perspectives and geographical contexts concerning urban agriculture. In essence, the Covid-19 pandemic acted as a turning point that caused urban agriculture to be resurgent worldwide in terms of practical and theoretical perspectives. However, due to the various forms, multiple benefits, and widespread adoption of urban agriculture during Covid-19, research scope and publication about urban agriculture covers broad areas and content across different disciplines, including agriculture, health, environment, economics, social science, engineering, public administration, and planning. Consequently, tracking research conducted on urban agriculture and Covid-19 is difficult and the scope of urban agriculture research in relation to Covid-19 remains ambiguous. This ambiguity affects the development of research topics moving forward. Therefore, as the pandemic slowly gets better and life returns to normal, a comprehensive study is required to assess and summarize research activities to reveal how urban agriculture-related research has been conducted in response to Covid-19. This is crucial for enhancing the understanding of the current status of the research landscape which covers a wide range of scientific disciplines and can serve as a pathway to develop future studies about urban agriculture's responses to Covid-19 and other crises.

The bibliometric analysis is a quantitative technique for systematic literature review and helps construct a research landscape by examining research overviews, publication trends, and themes, and by deciphering and mapping the current scientific knowledge from a massive amount of data from various sources, countries, and topics (Donthu et al., 2021; Zhang et al., 2022). Studies that adopted a bibliometric approach to characterize the research landscape about the Covid-19 pandemic both in general (Hamidah et al., 2020) and in specific fields, such as neurology (Zhang et al., 2022), food supply chain (Rejeb et al., 2022), management (Hashemi et al., 2022), environment (Casado-Aranda et al., 2021), and social science (Liu et al., 2022) have been undertaken. However, the topic of urban agriculture was overshadowed by the numerous articles on health, virus, and infection, as well as clinical and laboratory studies (Farooq et al., 2021; Hamidah et al., 2020) and a substantial volume of publications in medical science (Liu et al., 2022).

In addition, although there have been recent bibliometric analyses and systematic literature reviews in urban agriculture, the understanding of research on this topic in the context of Covid-19 has been neglected or limited due to the time scope. For instance, Ilieva et al. (2022) focused solely on the socio-cultural benefits of urban agriculture, while Zheng et al. (2023) concentrated on urban community gardens. Yan et al. (2022) conducted a bibliometric analysis of urban agriculture but only considered articles published between 2000 and 2021, resulting in very few Covid-19-related articles in their study. Dobele & Zvirbule (2020) analysed the development of the concept of urban agriculture between 1990 and 2019 and although Dobele et al. (2022)

extended the time scope of their study to 2021, the discussion of Covid-19 was still missing. In summary, despite the increased attention given to urban agriculture during Covid-19 and the multidisciplinary research conducted, the understanding of the research landscape addressing urban agriculture during Covid-19 remains unclear. Therefore, it is crucial to gain a better understanding of the current status of research in order to support further studies on the relationship between urban agriculture and Covid-19.

To fill this gap, this paper adopted a bibliometric analysis to examine the research landscape of urban agriculture and Covid-19 using articles from the Web of Science Core Collection (WoSCC), which arguably is the most authentic indexing and abstracting database (Farooq et al., 2021) and is the most selective academic database covering a high ratio of overlapping articles with other creditable databases such as Scopus and Dimension (Singh et al., 2021). As a result, selecting articles from WoSCC ensures the inclusion of the highest number of articles found in other creditable databases, thereby providing a representative view of the global research landscape. The articles encompass a range of keywords related to Covid-19 and urban agriculture, including various forms of urban agriculture such as urban farm, community garden, urban food production, allotment, and urban gardening. These terms are indicative of food production from the agricultural activities in the urban and peri-urban areas. The selection of these articles was used to conduct a bibliometric analysis to extend previous studies that usually focused on only one keyword or were not related to Covid-19 because of the time scope. In order to construct the research landscape, the following research questions were addressed: "what is the main contributor to constructing the knowledge about urban agriculture-related research on Covid-19?" and "what are the hot issues and essential themes for urban agriculture research in the context of Covid-19?". Both research questions are popular questions that researchers usually raise when conducting bibliometric analyses in order to understand the research landscape of a specific topic. The answers to the first research question support the understanding of research landscape by providing insights into the influential figures in the field of urban agriculture. Despite the global scope of Covid-19's impact and the widespread discussion and practice of urban agriculture, contributors to urban agriculture and Covid-19 research are disproportionately concentrated in certain regions due to various factors such as data availability and investment in scientific research. The answers about the contributors and their performance, evaluated through two components (the number of citations and the number of articles), thus enhance the understanding of the primary research directions, which constructs and affects the knowledge about urban agriculture during Covid-19. Furthermore, this specific analysis aids in identifying gaps within the research landscape. Regarding the second question, the findings about the hot issues and current themes are equally crucial for understanding the research landscape. Given that urban agriculture intersects with various disciplines and has been adopted to respond to Covid-19 for various purposes, the information about hot issues and current themes reveals the critical research areas, the popular topics, and the relationship between different topics. Accordingly, the results about the hot issues and current themes provide a deeper understanding of the past and present topics that can be used as a pathway to explore gaps and shape the directions of research in the future.

The remainder of this article is organised as follows. Section 2 describes the data and the details of the bibliometric analysis. Then, section 3 presents the results of the bibliometric analysis in four sub-sections, the overview of urban agriculture-related research related to Covid-19, the main contributors to urban agriculture research related to Covid-19, hot issues, and research themes. Section 4 provides a discussion that addresses the two research questions, while Section 5 summarises the article's findings as the conclusion. Finally, the limitations of this study are presented in section 6.

2. Methodology

This study adopted bibliometric analysis as the main quantitative approach to clarify the major contributors, hot issues, and research themes of urban agriculture research in the context of Covid-19. Bibliometric analysis is a traditional method to reflect the development of a given topic through a large amount of data (Donthu et al., 2021) by providing an overview of information, including sub-topics and critical themes, contributors such as researchers, countries, organisations, and publications, as well as the relevant keywords (Hamidah et al., 2020). Additionally, this method examines how these components are related to each other through mapping visualisation (Zupic & Cater, 2015). Zupic and Cater (2015) indicate that bibliometric analysis is a crucial method to support and improve the quality of the scientific literature review by creating a systematic, transparent, reproducible analysis and mitigating subjective bias. Hence, bibliometric analysis currently is a popular approach for reviewing the trends and progress of research (Farooq et al., 2021; Liu et al., 2022; Zhang et al., 2022). VOSviewer, a free programme commonly used in bibliometric analysis with the benefit of constructing bibliometric mapping (van Eck & Waltman, 2010), was used as the platform for this study. The study consisted of two main steps, as follows.

2.1 Data Collection

The articles related to urban agriculture and Covid-19 were collected on February 18, 2023, from the WoSCC. Bibliometric analysis commonly has been used to construct a knowledge landscape in many studies (Liu et al., 2022; Zhang et al., 2022). The articles were obtained by conducting a topic search that provided a more encompassing view of the two frequently used keywords, Covid-19 and urban agriculture. Specifically, for urban agriculture, this study attempted to expand the scope of urban agriculture considerations beyond previous surveys that only used the keyword "urban agriculture" (Yan et al., 2022) and, therefore, neglected other forms of urban agriculture. This study referenced the previous research by Ilieva et al. (2022), who used keywords related to the concept of urban food growing to study the bibliography in urban agriculture.

To derive related articles, the following search queries were used: *"((TS) = 'COVID 19' or 'Novel Coronavirus 2019' or 'Coronavirus disease 2019' or '2019-nCOV' or 'SARS-CoV-2' or 'coronavirus-2' or 'Covid-19') and ((TS) = 'urban farming' or 'urban farm' or 'urban agriculture' or 'community garden' or 'urban food production' or 'allotment' or 'allotments or 'urban agriculture' or 'urban gardening')".* The initial search results were then refined by publication years, limiting them to the period between 2020 and 2022, and document types, limiting them to articles or reviews. After that, the language of the search results was specified to be English.

During the initial search under the specified conditions, a total of 321 articles were extracted. However, some of the keywords can refer to studies unrelated to urban agriculture. For instance, "allotment" can sometimes refer to time allocation, and "community gardens" may pertain to rural contexts. Thus, articles' titles, abstracts, and keywords were screened for duplication and relevance by considering the content related only to food production from the agriculture activities in urban and peri-urban areas, which is the main concept of urban agriculture. Finally, 124 articles remained and were used as the data for the subsequent bibliometric analysis.

2.2 Conducting the Bibliometric Analysis

The articles with cited references from WoSCC were imported into VOSviewer to construct the research landscape by investigating three aspects: major contributors, hot issues, and research themes of urban agriculture

research related to Covid-19. Co-authorship analysis was employed to identify major contributors in three categories: authors, organisations, and countries. At the same time, citation analysis was adopted to investigate the source of the articles. To explore the hot issues, keyword co-occurrence analysis, which is a method to investigate the networks of the hot topic was conducted to examine and map the network of the hot issues from frequent author keywords. Lastly, for research themes, bibliographic coupling, which is a method to present the development of themes in a given field, was utilised with document unit analysis to group related articles. Then, the articles in each group were reviewed and analysed to identify the common themes.

3. Results

3.1 Overview of Urban Agriculture Research Related to Covid-19

From 2020 to 2022, a total of 124 articles were related to urban agriculture and Covid-19. The majority of these articles (56 articles) were published in 2022, followed by 48 articles in 2021. Only 20 articles were published in 2020. Furthermore, approximately 75% of these articles received citations. Among the cited articles, around 37% were cited between 2-10 times, while about 17% were cited between 11-20 times, and about 13% received only one citation. Notably, 2% of the articles received more than 100 citations. Interestingly, based on the author keywords, the top five most highly cited articles focused on urban agriculture, Covid-19, and the food sector, as shown in Table 1.

Table 1 Top 5 articles that gained the highest citation number

Title	Keywords	Citation
A critical analysis of the impacts of Covid-19 on the global economy and ecosystems and opportunities for circular economy strategies	Covid-19; Circular economy; Sustainability; Sustainable development; Supply chain resilience; Climate change	257
Home gardening and urban agriculture for advancing food and nutritional security in response to the Covid-19 pandemic	Food and nutritional security; Home gardens; Urban agriculture; Covid-19 pandemic; Malnourishment; Undernourishment; Human health	125
Agroecology and the reconstruction of a post-Covid-19 agriculture	Agroecology; Covid-19; vulnerability; equitable food systems; resilience	98
Food access in crisis: Food security and Covid-19	Food access; Food security; Food justice; Urban agriculture; Urban food system; Food policy; The commons; Covid-19; Structural disparities; Structural racism	96
Food First: Covid-Outbreak and Cities Lockdown a Booster for a Wider Vision on Urban Agriculture	Consumption habits; Farming; Food security; Food supply; Horticultural products; Lockdown; Resilience; Zero-acreage farming	95

3.2 Main Contributors to Urban Agriculture Research in the Context of Covid-19

3.2.1 Authors

A total of 489 authors produced articles on urban agriculture and Covid-19. About 95% of the authors have published only one article. Lisa Mullin, Sylvain Charlebois, and Janet Music from Dalhousie University published three articles together, making them the highest performers in terms of publication numbers. Meanwhile, T. Ibn-Mohammed and ten other authors who published “A Critical Analysis of the Impacts of Covid-19 on the Global Economy and Ecosystems and Opportunities for Circular Economy Strategies” had the highest performance in terms of citation numbers, with 257 citations. In addition, only two other authors had citations

higher than 100 times: Rattan Lal, who published one article on urban agriculture and food security during Covid-19, and Miguel A. Altieri, who published two articles about agroecology.

3.2.2 Source of Research

A total of 75 academic journals were the sources for the articles related to urban agriculture and Covid-19, covering 34 research areas. The majority of the articles were published in journals related to "Environmental Sciences & Ecology", followed by "Science & Technology - Other Topics", "Agriculture", "Urban Studies", "Food Science & Technology", "Geography", and "Public, Environmental & Occupational Health", respectively.

Table 2 shows that the journal "Sustainability" is the main source contributing to the knowledge on urban agriculture during Covid-19, with 19 published articles and the highest citation number of 304. The other publications represented fewer than ten articles with citations lower than 300. Considering the number of citations per document, the journal "Resources, Conservation and Recycling" had the highest performance, ranking second in terms of citation numbers, followed by the "Journal of Peasant Studies", which ranked fifth in terms of citation numbers. Furthermore, the "Journal of Food Security" performed well, ranking fourth based on the value of citations per article and third in terms of citation numbers. Interestingly, although the top 5 publications in terms of the number of articles, except for "Sustainability", had a higher number, they gained fewer citations, resulting in lower performance in terms of citation numbers and citation numbers per article.

Table 2 Top publication performances

(a) Top publication performance in terms of article number		
Ranking	**Publication**	**Number of articles**
1	Sustainability	19
2	Journal of Agriculture Food Systems and Community Development	6
3	Urban Forestry & Urban Greening	6
4	Frontiers in Sustainable Food Systems	5
5	International Journal of Environmental Research and Public Health	4
(b) Top publication performance in terms of citation number		
Ranking	**Publication**	**Number of citations**
1	Sustainability	304
2	Resources Conservation and Recycling	257
3	Food Security	137
4	Landscape and Urban Planning	121
5	Journal of peasant studies	98
(c) Top publication performance in terms of citation number per article		
Ranking	**Publication**	**Number of citations per article**
1	Resources Conservation and Recycling	257
2	Journal of Peasant Studies	98
3	Ecological Economics	96
4	Food Security	68.5
5	Environmental Pollution	51

3.2.3 Organisations

A total of 295 organisations contributed to the articles. Similar to the researchers, almost 90% of the organisations published only one article. The University of Melbourne in Australia had the highest number of publications, with four articles, followed by nine universities which published three articles each: Dalhousie University and University of Guelph in Canada, Humboldt University of Berlin and the Technical University of Munich in Germany, University of California Berkeley and the University of Minnesota in the United States of America (USA), University of Sheffield in the United Kingdom, Paris-Saclay University in France, and University of Putra Malaysia in Malaysia. Interestingly, most of the top ten published organisations are located in three developed countries: Canada, Germany, and the USA.

Considering the number of citations, the pattern of the top organisations differs from the number of publications. A total of 12 universities had more than 100 citations, with the University of Sheffield in the United Kingdom, being the top publishing organisation, at a citation count of 314. It is followed by the University of Kent in the United Kingdom and the University of Kebangsaan Malaysia, with citation numbers of 268 and 266, respectively. The remaining organisations with more than 100 citations are located in developed countries, such as London Birkbeck, University of London, London South Bank University, University of Nottingham, and University of Warwick in the United Kingdom, University of California, Berkeley and The Ohio State University in the USA, and University of Kyushu in Japan. Only two universities, Al-Hikmah University in Ilorin, Nigeria, and Sharjah American University of Sharjah in the United Arab Emirates, are organisations in developing countries with citations over 100 times.

3.2.4 Country

As shown in Figure 1a, scholars from 53 countries conducted research on urban agriculture and Covid-19. Developed countries such as the USA, Italy, Canada, Germany, and England published more than ten articles, with the USA producing the highest number of publications (36 works). Regarding the citations detailed in Figure 1b, 11 countries had a number of citations higher than 100 times. The USA still showed the highest performance, with the highest citation rate of 540 times. Meanwhile, England and Japan ranked second and third with citation counts exceeding 300 times. Based on co-authorship analysis that depicts international collaboration, England had the highest number of collaborations at 22 countries. Based on the collaboration mapping shown in Figure 1c, the countries were categorised into four groups based on their relationships. The USA, Canada, Japan, and Italy were the most significant nodes in each collaboration. The first group (pink colour) had a high contribution compared to other groups, with high-performance countries in publishing articles, such as the USA, England, Germany, and Australia. The second group (blue colour) had important countries such as Italy, France, Romania, and China. The Netherlands, Canada, and Brazil led the third group (green colour) while the last group (yellow colour) contained Japan, Malaysia, and Nigeria.

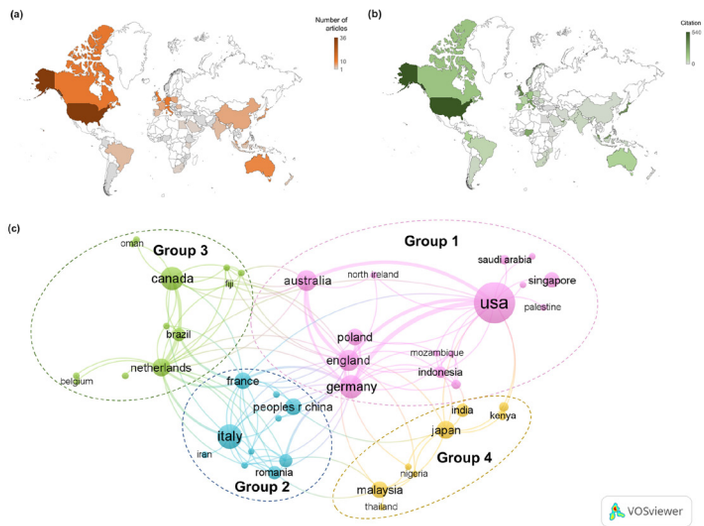

Figure 1 Major contributing countries: (a) distribution of countries contributing to the research divided by the number of articles; (b) distribution of countries contributing to the research divided by the number of citations; (c) collaboration of countries to conduct the research related to urban agriculture and Covid-19

3.3 Hot Issues of Urban Agriculture Research Related to Covid-19

The keywords co-occurrence analysis generated by VOSviewer revealed the hot issues of urban agriculture research in relation to Covid-19. The hot issues provided insights into the position of urban agriculture or the focal point of the researcher about urban agriculture in context of the Covid-19 pandemic. Out of the 401 keywords, 33 keywords were identified based on a minimum occurrence of three times. Covid-19 was the most frequent keyword used in the articles. Among the top 10 keywords excluding Covid-19, most of them were related to the form of urban agriculture and related activity, such as urban agriculture, community gardens, home garden, urban gardens, and gardening. They also were related to the food sector, such as food security/insecurity, food systems, and the food supply chain. Notably, keywords related to sustainability, such as resilience and sustainability, also had a high occurrence rate. Besides, the keyword well-being, which is related to health concepts, occurred frequently.

A map of keyword co-occurrence is presented in Figure 2a. The circle size indicates the frequency of occurrence, while the link between keywords illustrates their co-occurrence. Additionally, the distance between keywords implies their relatedness. Among the top keywords, food security and insecurity are strongly related to urban agriculture and Covid-19, based on their proximity distance. The keywords were categorised into five groups. The first group (blue colour) included the main keywords such as Covid-19 which linked to some forms of urban agriculture such as gardens, the benefits of urban agriculture for health, and the function in ecosystems service and nature-based solutions. The keywords in this group included allotment gardens, Covid-19, ecosystem services, gardening, gardens, green space, health, mental health, nature-based solutions, urban gardens, and well-being. The second group (green colour) contained the main keywords such as urban agriculture and keywords related to the food sector, such as food access, food networks, food policies, and food systems. Additionally, public health and governance links to food access and food networks were grouped in this cluster. The third group (orange colour) consisted of keywords related to sustainability issues such as agroecology, climate change, food sovereignty, resilience, and sustainability. The fourth group (yellow) was related to the food sector by linking to the lockdown situation and home garden. The keywords in this group

included food security/insecurity, food supply chains, home gardens, lockdown, and urban areas. The last group (pink colour) consisted of basic keywords like urban and keywords related to urban agriculture's forms and techniques, such as community gardens, hydroponic systems, urban farming, and vertical farming.

A density map (Figure 2b) was constructed to present the most important issues, with the red colour representing the highest density of keyword co-occurrence, while the blue colour represents the lowest. Density is determined by the number of items in the surrounding areas and the importance of those items, which is calculated based on their total occurrences (van Eck & Waltman, 2010). The core research or hot issues in urban agriculture research related to Covid-19 included Covid-19, food security and insecurity, urban agriculture, home gardens, and resilience. Other important issues with lower densities included food supply chains, sustainability, food policy, the food system, community gardens and gardening, well-being, health, and nature-based solutions.

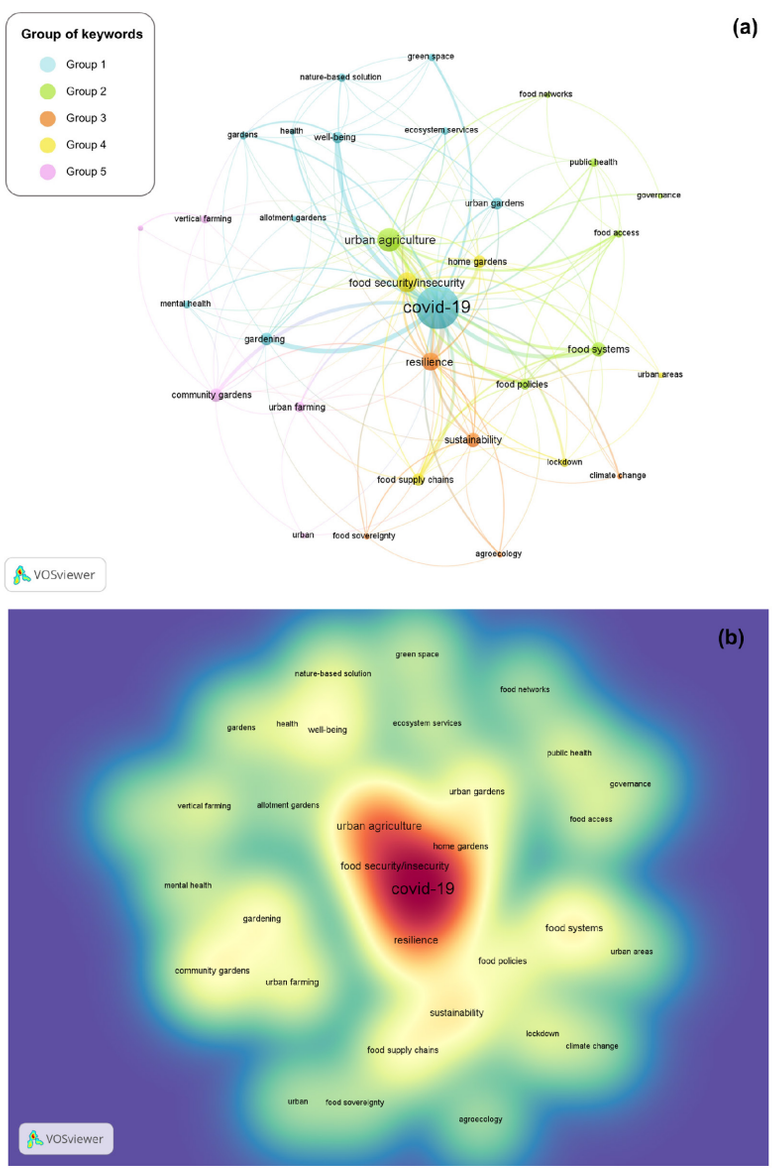

Figure 2 Author keywords frequently occurring in the articles: (a) keyword co-occurrence mapping; (b) density mapping

3.4 Research Themes of Urban Agriculture and Covid-19

The bibliographic coupling analysis was adopted to categorise the research themes of the urban agriculture research related to Covid-19 into eight groups from 117 out of 124 articles that are interconnected, as shown in Figure 3. About 30% of the articles were grouped under the first research theme, focusing on urban agriculture and impact of Covid-19 on the food sector. At the same time, almost 15% of the articles were grouped under the second research theme, concentrating on the benefit of urban agriculture in terms of health and well-being. Additionally, about 12% were grouped under the fifth research theme that discussed the practice of community gardening during Covid-19. The remaining research themes each contained a similar number of articles which covered about 8% of the articles per research theme.

As shown in Figure 4, the majority of research themes witnessed an increase in the number of articles from 2020 to 2022, with the exception of the second and third research themes. Although the second research theme held the second-highest count of articles throughout all time periods, the number of articles decreased after 2021, subsequent to its position as the second-highest. Similarly, the third research theme initially got attention but experienced a reduction in the number of articles in 2021, ultimately disappearing in 2022. It is interesting that while other research themes increased gradually, the fifth and eighth research themes which discussed community gardens and technology increased quickly from 2021 to 2022. However, the article count for both research themes remained low in comparison to the counts of the first and second research themes.

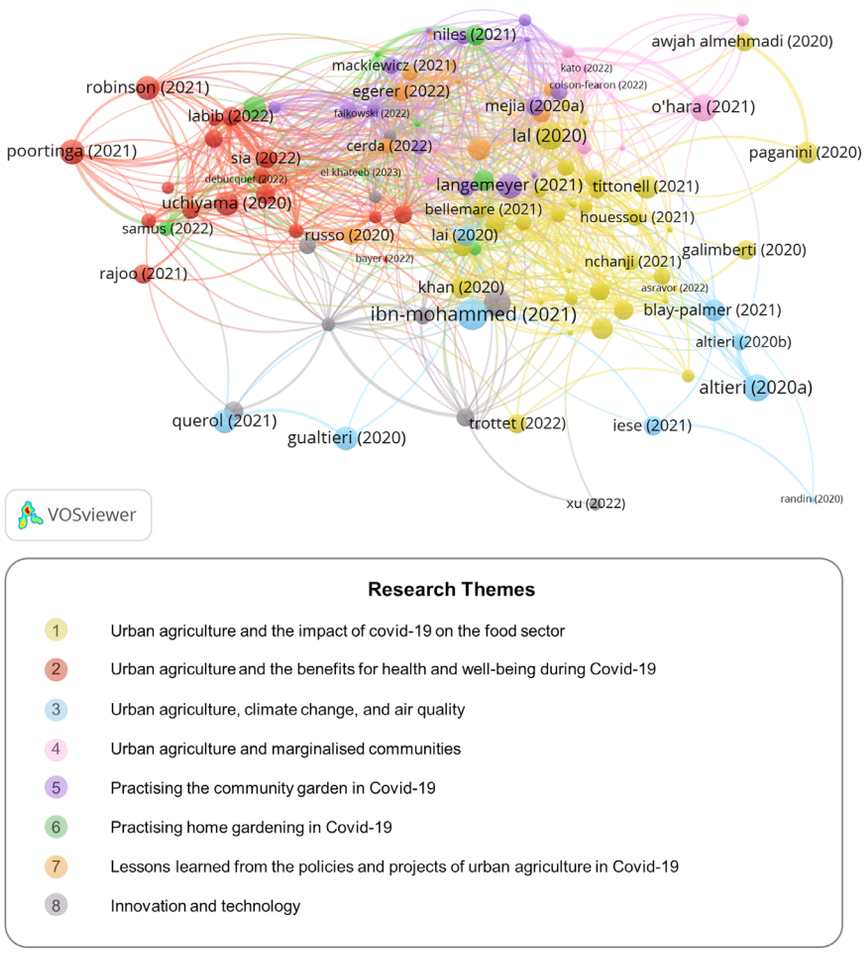

Figure 3 Research themes of urban agriculture and Covid-19

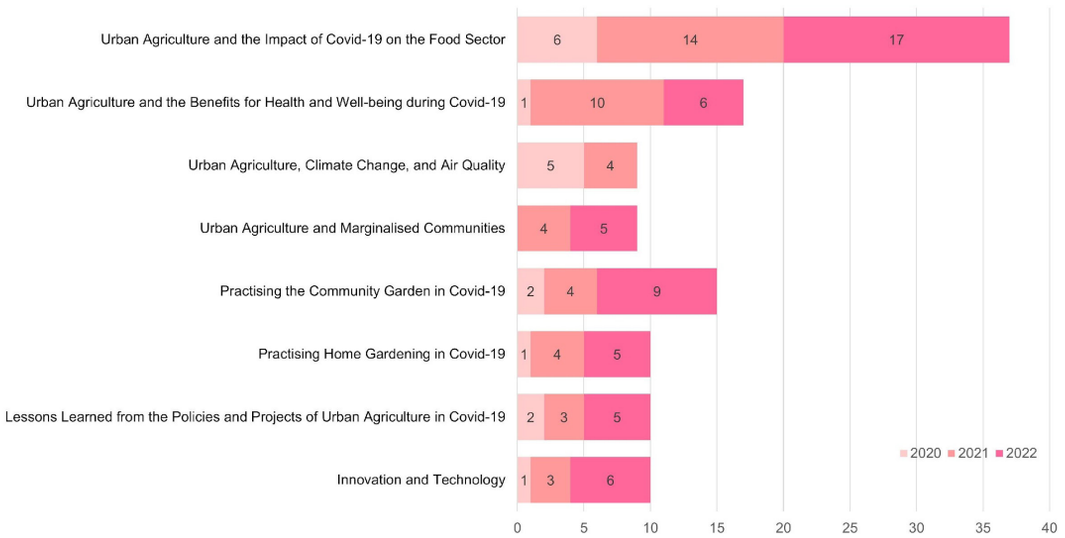

Figure 4 Number of articles in each research theme of urban agriculture and Covid-19

3.4.1 Urban Agriculture and the Impact of Covid-19 on the Food Sector

This research trend is the intersection of urban agriculture and Covid-19, with 37 articles related to the food sector, such as food production, food supply chains, food system, and food security. The most cited article in this group is the study of Lal (2020), which indicated that the Covid-19 pandemic caused a disruption in the food supply and the accessibility to food for urban dwellers, making it necessary for urban society to adopt resilient and sustainable food systems such as urban agriculture to strengthen local food production and support food and nutritional security. Due to the large number of articles, the research trend in this group addressed three main topics: (1) the benefits of urban agriculture to overcome the impact of Covid-19 on food supply, food production, and the food system, (2) the impact of Covid-19 on practitioners and growers of urban agriculture, and (3) the implementation of urban agriculture in terms of policy and planning.

For the studies about the benefits of urban agriculture to overcome the impact of Covid-19 on food supply, food production, and food systems, many articles proposed that urban agriculture was a potential approach to overcome the problems of the food sector in urban areas during Covid-19 such as food insecurity, food accessibility, or food supply chain disruption (Khan et al., 2020; Lal, 2020; Sridhar et al., 2022). Urban agriculture generates a short food supply chain by localising the food supply chain and food production, thus increasing food accessibility (Kang et al., 2021; Nchanji & Lutomia, 2021; Sridhar et al., 2022) while concurrently promoting a more resilient, equitable, and sustainable food system (Galimberti et al., 2020). Hence, in order to recommend urban agriculture as a response to the negative effects on food systems, the studies within this group mainly discussed the effects of Covid-19 on the food sector in different geographical and temporal contexts. For example, Vittuari et al. (2021) revealed short-term and long-term impacts of Covid-19 on the food systems. Kang et al. (2021) compared the effects of Covid-19 on food security in urban and rural areas of the Asia Pacific region. Likewise, Asravor and Kwakwa (2022) analysed the effects of Covid-19 on the food security status of urban households in Ghana.

The second main topic was related to studies about the impact of Covid-19 on practitioners and growers, who are crucial drivers in the supply chain of urban agriculture. For example, Manda (2022) analysed the impact of Covid-19 policy responses on small-scale farmers' livelihood and food security, as well as their coping strategies in Zambia. Paganini et al. (2020) analysed the challenges, impact on livelihood, changes in consumption due to food price fluctuations, and coping strategies of small-scale farmers in Indonesia, Mozambique, South Africa, and Zimbabwe. Yoshida and Yagi (2021) and Grigorescu et al. (2022) explained the impact of Covid-19 and the adaptability of urban farmers and farms during Covid-19 under the concept of resilience.

The last main topic addressed was urban agriculture in terms of policy and planning. Despite receiving attention and in some ways already being implemented in plans and policies, there remain limitations and barriers to implementation. While other studies suggest practising urban agriculture to cope with Covid-19, the studies in this group have narrowed the focus to the strategy, policy, and planning to support the construction of suitable urban agriculture policies that promote the food sector and sustainable urban development. For example, Hanna and Wallace (2022) examined how urban agriculture was supported or constrained in local planning by using the regulations of New Zealand as a case study. Tittonell et al. (2021) analysed the initiatives of family farming and the agroecology movement to support food security in Latin America. Ghezeljeh et al. (2022) discussed the policy on food security and urban agriculture in Canada, the barriers, and the effective strategies and planning for improving urban agriculture. In addition, the studies in this group focused on the factors involved in adopting the concept of urban farming and the barriers to its practice (Ivascu et al., 2021) or the perceived value and problems of practising urban agriculture (Sylvester et al., 2022). This information is crucial for policymakers to understand how to promote suitable policies that support urban agriculture.

3.4.2 Urban Agriculture and the Benefits for Health and Well-being during Covid-19

The research in this group is related to the benefits of urban agriculture for health and well-being during Covid-19. Most studies focused on the access to or activities in green areas and gardens, with the benefits for health and well-being as common themes. For example, the study by Poortinga et al. (2021), which is the highest-cited article in this group, analysed the role of parks and gardens in promoting health and well-being in the United Kingdom and the relationship between perceived access, subjective well-being, and health during and after Covid-19. Labib et al. (2022) reviewed the effects of exposure to nature, including various forms of agriculture, on health during Covid-19. Interestingly, among the various reports about the benefits for health and well-being, many studies focused on the advantages for psychological and mental health (Basu et al., 2021; Marques et al., 2021; Sia et al., 2022; Zhang et al., 2021).

Additionally, to reveal the benefits of activities in urban agriculture for health and well-being during Covid-19, this group of papers also investigated the behavioural changes in the use of green areas before and during the pandemic, as well as the drivers behind visits to green areas. For example, Khalilnezhad et al. (2021) explored the changes in the use and motivation to visit a green space in Iran before and during Covid-19. Dawwas and Dyson (2021) examined the changes in outdoor activities in home gardens, urban parks, and natural areas during the Covid-19 pandemic in Palestine. The benefits of urban agriculture for health and well-being were revealed through various studies in different regions, such as Iran (Khalilnezhad et al., 2021), Germany (Säumel & Sanft, 2022), Singapore (Sia et al., 2022), Brazil (Marques et al., 2021), India (Basu et al., 2021), and Indonesia (Harding et al., 2022).

3.4.3 Urban Agriculture, Climate Change, and Air Quality

The studies in this group focused on urban agriculture, climate change, and air pollution. Urban agriculture was positioned as a practice or strategy to mitigate the negative impact of climate change and Covid-19. For example, Ibn-Mohammed et al. (2021) analysed the effects of Covid-19 on the economy and recommended transforming the actual economy to a circular economy thereby enhancing profitability while minimising the negative impact on the environment post-Covid-19. In this context, urban agriculture was assigned as part of the circular economic strategy to support the food sector with the bio-cycle economy by producing fresh food within near proximity to urban agriculture, thereby decreasing greenhouse gas emissions, as a climate change mitigation strategy. Altieri and Nicholls (2020) indicated that urban agriculture, as part of the agroecology practice, should be adopted in the post-Covid-19 period since this system is the best agricultural system to cope with crises like Covid-19 while also having the potential to mitigate the negative impact of climate change. Blay-Palmer et al. (2021) also proposed that urban agriculture is a crucial practice in the City Region Food System approach that will ensure regional sustainability and resilience in the food system, responding to the pandemic and climate change. Furthermore, studies in this group focused on air quality during Covid-19, discussing the activities in agriculture areas as a source of air pollution in urban areas (Gualtieri et al., 2020).

3.4.4 Urban Agriculture and Marginalised Communities

The research in this group focused on urban agriculture and its relation to marginalised communities, which is linked to topics such as racism, inequities, and disparities. The studies explored the racism, inequities, and inequalities faced by marginalised populations during Covid-19 (Colson-Fearon & Versey, 2022), with urban agriculture being introduced as a potential solution to address issues of food access and inequities faced by these communities (Colson-Fearon & Versey, 2022; Kaika & Racelis, 2021; O'Hara & Toussaint, 2021). However, there are contradictory studies that call for a rethinking of the policy of urban agriculture practices in marginalised communities, taking into account the lens of structural extermination (Toussaint, 2021) and the settler-colonialism and post-colonial literature on cities and urban planning (Sassano et al., 2022).

3.4.5 Practising the Community Garden during Covid-19

The research in this group focused on the "community garden", and most of the studies explored its role and benefits. For example, Janowska et al. (2022) reviewed the role and benefits of the community garden and presented case studies from Poland. Mejia et al. (2020) analysed the role of community-based agriculture in food security and psychological benefits. Interestingly, the benefits of the community garden also were emphasised in university settings (Walshe & Law, 2022). In addition, the studies focused on the interaction between the gardener and gardening. For example, Joshi and Wende (2022) analysed the impact of the gardener in the community garden during Covid-19 and discussed its social and community benefits in the framework of urban social resilience. Kingsley et al. (2022) analysed changes in gardening experiences during Covid-19, reflecting on the experiences, barriers, adaptive solutions, and benefits of gardening. Moreover, the studies in this group focused on community gardens in planning and land-use decision-making. For example, Zheng et al. (2022) analysed the residents' willingness to build community gardens in Wuhan, which was crucial in implementing the community programme and designing the management model in the post-Covid-19 era.

3.4.6 Practising Home Gardening during Covid-19

The main topic of the studies in this group was the home garden. Most of the studies analysed the various perspectives of the home garden by focusing on its benefits. For example, Sofo and Sofo (2020) examined home garden practices and their benefits during Covid-19. Niles et al. (2021) analysed the relationship between home food procurement and its impact on food security. Samus et al. (2022) explored the relationship between the benefits of mental health and the characteristics of a private garden. In addition, the characteristics of the participants in home gardening were discussed, and included consideration of gender (El Khateeb et al., 2023), socio-demographic background (Chenarides et al., 2021), actor-network in home gardening (Taylor & Lovell, 2021), drivers to adopt the home garden (Hunt et al., 2022), as well as attitudes and practices for plant care in private housing (Debucquet et al., 2022).

3.4.7 Lessons Learned from the Policies and Projects of Urban Agriculture during Covid-19

The main focus of the studies in this group was urban agriculture policy to respond to the impact on the food sector and urban development during Covid-19. The projects and policies were adopted as case studies. For example, Music et al. (2021) discussed the adoption of urban land-use policies of Victory Gardening, which is home gardening, to combat food disruption in Canada during Covid-19. Music et al. (2022) discussed the urban agriculture programmes in Canada and evaluated 19 urban home food gardening programmes under various topics such as organisation, barriers, policies, and plans. Russo and Cirella (2020) examined the benefits of urban agriculture and regeneration policy using the case study of ten edible green infrastructure projects from Italy. Additionally, stakeholders and networks that integrated urban agriculture into the food systems were discussed (Harden et al., 2021). Interestingly, while urban agriculture policies and projects were suggested to cope with food security and resilience, Cattivelli's (2022) study challenged this argument by analysing food sufficiency through the urban agriculture practices lens. This is similar to the study of Perks et al. (2022), which attempted to present an overly optimistic view of urban agriculture practices.

3.4.8 Innovation and Technology

Most studies in this group focused on innovations and technologies to enhance the capacity of urban agriculture. Existing innovations and technologies in urban agriculture were reviewed to explore the performance of urban agriculture in response to Covid-19 (Pulighe & Lupia, 2020). Among the various forms and technologies of urban agriculture, the vertical garden is a hot topic that was discussed during Covid-19. The benefits of vertical gardening were reviewed at various scales (Zarębа et al., 2021), and it was identified as a technique suitable for integration into design to create a healthy building in the post-Covid-19 era (Navaratnam et al., 2022). At the same time, integration with current innovations and technologies such as automation and the Internet of Things (IoT) was discussed regarding the transformation into smart agriculture (Oh & Lu, 2023; Saad et al., 2021). Additionally, Shahda and Megahed (2022) proposed that the vertical garden is an alternative solution that should be integrated into skyscrapers as an innovative approach to respond to post-pandemic issues. Other technologies and new approaches that can enhance the performance of urban agriculture practices also were studied, such as the solar-assisted hydroponic farm (Xu et al., 2022) and the new governance approach for managing ecosystem services to support small-scale urban green infrastructure (Razzaghi Asl & Pearsall, 2022).

4. Discussion

Urban agriculture is a practice related to urban planning (Dobele & Zvirbule, 2020; Simon, 2023; Yan et al., 2022) that gained increased attention during Covid-19. Bibliometric analysis showed a significant increase in research on urban agriculture in relation to Covid-19 from 2020 to 2022. By extending the search scope to cover other forms of urban agriculture and the time scope to include 2022, which has the highest number of articles, the research about urban agriculture in the context of Covid-19 became more detailed. The increase in the number of articles about urban agriculture and Covid-19 in WoSCC from 2020 to 2022 reflects the active and promising nature of urban agriculture practices. It also highlights the crucial role that urban agriculture played in mitigating the impact of Covid-19. In addition, based on the number of citations, the topic of urban agriculture is gaining attention and has promoted a quick response within the scholarly circle. Approximately 75% of the documents were cited despite being published within the last three years. Our findings, which included an updated search scope and time period, contrast with a recent bibliometric analysis of urban agriculture by Yan et al. (2022), that indicated there were few publications on urban agriculture and Covid-19, implying that this practice was slow to respond to a global crisis.

According to the first research question that examined the main contributors to the knowledge construction about urban agriculture research related to Covid-19, most of the contributors in every unit of analysis, such as authors, sources, organisations, and countries, only contributed one article. The limitation of data due to the relaxation of travel restrictions, the adaptation of daily life, and the decrease of Covid-19 cases seem to be crucial factors that prevented most contributors from continuing their research and publishing their work. In addition, despite the global scope of the research, the main contributors with high performance in publishing articles primarily were from developed countries such as the USA, Italy, Canada, Germany, and England. The main authors who contributed to the research also were affiliated with institutions in developed countries. For example, the authors who published the highest number of articles were affiliated with Dalhousie University in Canada. Similarly, the authors of the most highly cited articles generally are from the United Kingdom, although there are a few authors from developing countries such as Malaysia, Nigeria, and the United Arab Emirates. Furthermore, the top contributing organisations are located mainly in developed countries, such as Canada, Germany, the USA, and France. In general, developed countries are the major contributors to constructing the research landscape of urban agriculture and Covid-19. This is consistent with other sciences related to Covid-19, where organisations in developed countries are the main contributors to knowledge (Mahi et al., 2021; Zhang et al., 2022). Zhong et al. (2021) indicated that a significant investment in scientific research is a crucial reason leading to the prevalence of published articles in developed countries.

Among the group of developed countries, the USA was the most prolific contributor, with the highest number of publications, exceeding 30 works, and the highest citation rate of 540 times. This is consistent with other studies which showed the USA as the country with the most prolific performance in publishing articles about Covid-19 in general and in specific fields of science (Farooq et al., 2021; Liu et al., 2022; Zhang et al., 2022). However, these results are not surprising because the USA is not only the country that hit the highest number of Covid-19 cases and the front-row country in producing research about Covid-19, but it also has been identified as the most influential country in contributing to urban agriculture prior to Covid-19 (Dobele & Zvirbule, 2020; Yan et al., 2022). As a result, it is likely that researchers in the USA applied their existing research experience in agriculture to respond to the high severity of Covid-19, making the country a leader in this field.

While the knowledge base regarding urban agriculture and Covid-19 was constructed and shaped mainly by developed countries. It is important to note that developed and developing countries experienced different effects from Covid-19 (X. Jiang et al., 2021), leading to varying contexts, problems, and limitations in adopting urban agriculture practices (FAO, 2022; Taguchi & Santini, 2019; Zhong et al., 2021). Relying primarily on case studies from developed countries for knowledge extraction falls short in understanding urban agriculture during Covid-19. This creates a notable research gap that requires further investigation in developing countries to deepen the understanding of urban agriculture during Covid-19 and to support the practice of urban agriculture in the future as a response to global crises (Kakaei, et al., 2022; Saboori et al., 2022).

Our review indicates that research on urban agriculture is related to multidisciplinary science. Most articles were published in journals related to Environmental Sciences & Ecology, Science & Technology, Agriculture, Urban Studies, Food Science & Technology, Geography, and Public, and Environmental & Occupational Health. This diverse range of publication areas has led to articles being presented from various perspectives, such as sustainability, food systems, environment, public health, urban planning, and others. The variety of sources implies that urban agriculture has been applied and discussed to mitigate Covid-19 impacts from various dimensions, highlighting its nature as a multidisciplinary science. This goes beyond the fundamental role of urban agriculture in the food sector, expanding to encompass areas such as health, ecosystems, and planning to promote urban agriculture and support sustainable development. The variety of sources publishing research on urban agriculture during Covid-19 thus is in accord with the characteristics of urban agricultural practice as an approach to increase the resilience of cities during times of crisis. This approach not only addresses food security but also extends its benefits to health, social issues, environment, and economy (Gulyas & Edmondson, 2021; Yuan et al., 2022).

“Sustainability” had the highest publication performance in terms of the number of citations and articles. This achievement can be attributed to the broad scope of journals that encompass sustainability across a range of dimensions, including technical, environmental, cultural, economic, and societal perspectives. This wide coverage contributes to the substantial number of articles compared to journals which have a more specific scope. However, the journal “Sustainability” not only emerged as a primary source of published articles related to urban agriculture and Covid-19, but it has also held this position from 2000 to 2021 in the field of urban agriculture (Yan et al., 2022). Furthermore, it is a main source of publications related to Covid-19 across other specific sciences, such as economics (Mahi et al., 2021).

Regarding the second research question about hot issues and essential themes in research on urban agriculture and Covid-19, keyword co-occurrence analysis indicates that food security and insecurity are the central issues of the research, with the food supply chain and food system also identified as hot issues. Among the eight themes identified in this study, food security and insecurity were discussed directly in the first research theme (urban agriculture and the impact of Covid-19 on the food sector), which had the largest number of articles. In addition, these issues were discussed indirectly in other research themes, such as urban agriculture, climate change, air quality, urban agriculture and marginalised communities, practising the community garden in Covid-19, and practising home gardening in Covid-19. The focus on food security and the food system is not a new research trend in the circle of urban agriculture research (Dobele & Zvirbule, 2020; Yan et al., 2022). However, under the situation that the food system was disrupted worldwide due to Covid-19, and numerous cities and billions of people around the world encountered severe problems associated with the food sector, such as food availability, food security, or food access (Hammad et al., 2023), research about urban agriculture

gained new traction. Urban agriculture, with its core function of supporting food production within cities and its recognition as a resilient food system capable of crisis response, received extensive attention as the major trend to address food security. Interestingly, although the food sector was the key theme of urban agriculture research before Covid-19, research on urban agriculture and Covid-19 expanded the research scope from previous studies that usually focused on analysing the potential of urban food agriculture to support and mitigate the problems associated with the food system, fostering resilience and sustainability in order to respond to urbanization (Yan et al., 2022; Yuan et al., 2022). The focus has shifted to encompass analysis regarding the problems and the adaptation of practitioners and growers engaged in urban agriculture, which is a part of the food system that was less addressed earlier.

Research on urban agriculture during Covid-19 is not solely associated with the food sector. Although it is not the core research area based on the word occurrence analysis, the bibliographic coupling analysis revealed that studies about the benefits of urban agriculture for health and well-being during Covid-19 also was a popular research theme. Covid-19 has affected human life in every dimension, not just in the food sector. In combatting Covid-19 with the travel restriction policies, humans worldwide also encountered stress and health-related problems, turning it into a hot issue in various sciences. This encompasses not only health science research (Zhang et al., 2022), but also includes other disciplines, such as social science, management (Hashemi et al., 2022) and economics (Mahi et al., 2021). These studies aimed to understand the health and well-being implications during the crisis and seek solutions. Given that urban agriculture has been widely proven to enhance well-being and mental health before Covid-19 (Audate et al., 2019), it is logical that numerous studies were conducted when humans encountered a crisis impacting health and well-being. However, most of the studies on this issue are associated with access to the areas of urban agriculture and lockdown policies, which is limited in terms of time span and the number of areas. This limitation likely contributes to the relatively lower volume of research on this subject although well-being and health issues were crucial for research during Covid-19.

While about 46% of the publications focused on the analysis and benefits associated with the food sector and health, as shown in the first and second research themes, other topics were discussed to some extent. These topics included the practice of urban agriculture during Covid-19, climate change, and air quality which is a global issue. Specific forms of urban agriculture, such as community garden and home garden also were explored. Additionally, discussions encompassed policies and projects for urban agriculture during Covid-19, as well as innovations and technologies to enhance the performance of urban agriculture implementation and practice. The overview thus implies that during Covid-19, researchers mainly focused on urban agriculture as a crucial alternative solution to address problems in the food system and health and well-being, which emerged as main issues during the pandemic. However, even though the other research themes covered a smaller number of articles, these research themes were not neglected by scholars because the attention on almost all research themes increased from 2020 to 2022, except for the research about urban agriculture, climate change, and air quality and the research about urban agriculture and the benefits for health and well-being during Covid-19. This decline in these themes could be attributed to the easing of Covid-19 travel restrictions, which has contributed to the recovery of people's mental health (D. Jiang et al., 2021). Moreover, the limitations during Covid-19 in conducting case studies, which usually focus on access to urban agriculture areas, seems to be a crucial reason contributing to the decline of interest in these themes. As a result, the number of articles in the research theme about health and well-being decreased.

Research about urban agriculture is likely to decrease due to limited data availability and the recognition of its important role as a crisis-response solution. However, urban agriculture still maintains a role as a resilient system to address other global issues like global warming and poverty. The first three years of studies about urban agriculture and Covid-19 have focused on the benefits of urban agriculture, analysis of the problems of agriculture, and suggestions of various approaches through the transcription of practical lessons to explain the conditions and impact of urban agriculture in coping with Covid-19 and attracting engagement. Future studies should pay more attention to post-crisis phases by comparing the benefits, adaptations, and practices of urban agriculture with the event before, during, and after the pandemic. This comparative analysis should ascertain differences, characteristics, or factors influencing sustainability in practice, aiming to be used in planning to promote long-term practice in which human beings have to coexist with Covid-19 and other global issues.

Based on the results addressing the two research questions, we conclude that although there are numerous studies about urban agriculture and Covid-19 to support and develop the urban agriculture practice worldwide, the research landscape of urban agriculture with Covid-19 has remained largely unchanged from the research landscape of urban agriculture without Covid-19. In terms of contributors, developed countries continue to play the most crucial role in contributing knowledge about urban agriculture, with the USA retaining its status as the most influential country (Dobele & Zvirbule, 2020; Yan et al., 2022). At the same time, most articles about urban agriculture and Covid-19 continue to be related to environmental sciences, ecology, and agriculture, which represent the main academic fields of urban agriculture studies in the 21st century (Dobele & Zvirbule, 2020). Similarly, the journal “Sustainability” remains a primary contributor in shaping the research landscape, a role it also occupied before the Covid-19 pandemic (Yan et al., 2022). Interestingly, while developed countries in Europe and the USA remain major contributors to the studies of urban agriculture during Covid-19, the countries in Africa, which have more contribution regarding research about urban agriculture associated with poverty (Audate et al., 2019; Dobele & Zvirbule, 2020), seem to lose their role in providing case studies and knowledge on urban agriculture and Covid-19.

In terms of the hot issues and research themes, the discussion surrounding urban agriculture and the food sector which is the original concept of research in the urban agriculture is still the mainstream (Dobele & Zvirbule, 2020). However, it is interesting that although urban agriculture and food security remain prominent topics in the world of urban agricultural research, the frequency of other keywords differs, revealing variations in the research framework and focus between pre-Covid-19 and during Covid-19 periods. Compared to previous studies about urban agriculture (Yan et al., 2022), a keyword frequency analysis shows that most studies about urban agriculture usually are associated with urban planning, urbanization, and sustainable development. As a result, most previous research treats urban agriculture as a sustainable solution to improve food production and provide various benefits to address problems arising from urbanization and support sustainable development by integrating the urban agriculture practice into urban planning. However, these keywords receive less attention in research about urban agriculture and Covid-19. They were replaced by “well-being” and the keywords about the food system which was treated as a resilient system. Examples of these terms include “food systems”, “food supply chain”, and “resilience”. In association with Covid-19, research on urban agriculture has shifted its focus. It has transitioned from addressing issues stemming from urbanization, which exerts pressure on food supplies due to high population density and other global issues affecting sustainability. Instead, it discussed sudden problems in the food and health sectors that have arisen as a result of the pandemic. In addition,

"home garden" emerged as a crucial new keyword in research associated with Covid-19. The limitation of travel due to the restrictions and lockdown policies, preventing people from leaving their residences, seems to be a crucial reason why this form of urban agriculture gained more attention and research than in previous times. Furthermore, it is interesting that less attention was paid to "urban planning" in research about urban agriculture during Covid-19 (Hanna & Wallace, 2022). Although urban agriculture practices and research received more attention during Covid-19, this shift also has presented obstacles to urban agriculture (Cerda et al., 2022), emphasising the need for further studies in the future. The focus on food security identified by our analysis reveals the need for urban planning to integrate food or urban agriculture as part of its agenda (Basu et al., 2021; Simon, 2023). This agenda might consider supporting the use of underutilised spaces in urban areas for food production (Glaros et al., 2022) or creating zones for urban agriculture (Ghezeljeh et al., 2022) to mitigate spatial problems or barriers such as the lack of or inadequate space for gardening (Cerda et al., 2022).

Within the broad scope associated with various disciplines and different geographical contexts of research about urban agriculture during Covid-19, this study holds implications for a better understanding of the research landscape of urban agriculture in terms of theoretical perspectives by consolidating related articles and clarifying the hot issues, research themes, and main contributors. Additionally, from a theoretical perspective, this study extends previous understanding, which indicated limited contributions and slow responsiveness of urban agriculture research to the challenges posed by Covid-19. It also engages in a discussion with previous research trends that had not adequately considered the influence of Covid-19 to shape their specific focus. Finally, our study highlights gaps in research and offers suggestions for future research.

5. Conclusion

This article is a bibliometric study focusing on research related to urban agriculture and Covid-19, which gained more attention worldwide from 2020 to 2022. The study aimed to provide an overview of the research landscape, encompassing crucial contributors, hot issues, and research themes, in order to shed light on existing research and the role of urban agriculture during the Covid-19 pandemic. Based on the bibliometric analysis, this study pointed out that research about urban agriculture and Covid-19 has been published across various scientific disciplines, with the journal "Sustainability" serving as the main platform. Although the research about urban agriculture and Covid-19 has been conducted worldwide, developed countries, especially the USA, continue to be the primary contributors in this field. They were prominent in terms of both scholars and organisations engaged in Covid-19 related research. The research about urban agriculture and Covid-19 was conducted within eight research themes, focusing on the impact, benefits, and behaviour of urban agriculture practice in response to the negative impact of the pandemic, especially in the food sector and health. This emphasis underscored the role of urban agriculture in coping with the crisis. The research also focused on policy and technology development to enhance the performance of urban agriculture during and after the pandemic. Additionally, the concentration on various forms of urban agriculture research within the context of the pandemic and the food sector was reflected in the keyword-occurrence analysis in which Covid-19, food security and insecurity, urban agriculture, home gardens, and resilience were identified as the hot issues of core research.

6. Limitations

This study has some limitations. The first limitation relates to the database used. Although WoSCC is an accepted and widely used database for research landscape analysis, there are numerous articles published in other databases such as Scopus and country-specific journal databases that may not have been captured in our study. The second limitation is the language restriction. This study only considered publications in English, which means that articles published in other languages, such as Japanese, Thai, and Chinese, were not included. This exclusion may have resulted in a smaller number of articles on urban agriculture than the actual reality. It is essential to consider articles from other databases or languages in future research to enhance the understanding of urban agriculture and Covid-19 research.

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Author Contributions

Conceptualization, S.S. and S.B.; methodology, S.S. and S.B.; formal analysis, S.S. and S.B.; formal analysis, S.S. and S.B.; writing - original draft, S.S. and S.B.; writing - review & editing, S.S. and S.B.; visualization, S.S. and S.B.; funding acquisition, S.S. All authors have read and agreed to the published version of the manuscript.

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