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LITERATURE REVIEW
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Global Trend of Stunting in The Last Decade: A Bibliometric Analysis

Tren Global Stunting dalam Satu Dekade Terakhir: Analisis Bibliometrik

Yohanis Ndapa Deda[1]*, Maria Paula Marla Nahak[2], Aplonia Pala[3]

[1]Mathematics Education Department, Faculty of Teacher Training and Education, Universitas Timor, Jl. Km 09 kelurahan Sasi, Kota Kefamenanu, TTU, NTT, 85613, Indonesia
[2]Nursing Study Program, Universitas Timor, Jl. Km 09 kelurahan Sasi, Kota Kefamenanu, TTU, NTT, 85613, Indonesia
[3]Public Administration Study Program, Universitas Timor, Jl. Km 09 kelurahan Sasi, Kota Kefamenanu, TTU, NTT, 85613, Indonesia

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Correspondent:
Yohanis Ndapa Deda
yndapadeda@unimor.ac.id

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ABSTRACT

Background: Stunting is a growth and development problem in children caused by chronic malnutrition and disease. There is no bibliometric analysis related to stunting globally and simultaneously using metadata from GS (Google Scholar) and Scopus on Vosviewer visualization from 2012 to 2022.
Objectives: To study the trends in research on stunting through a bibliometric analysis of the widely used GS and Scopus databases.
Methods: This method was used to investigate and evaluate a large amount of scientific data on stunting, revealing the intricacies of the evolution and novelties related to stunting over a decade (2012-2022).
Discussions: Stunting studies have increased over the last decade (2012-2022). The authors most cited based on the Scopus database are Prendergast & Humphrey. The authors most cited based on the GS database is de Onis & Branca. The productive author based on GS is T Siswati from Indonesia. The top numbers one influential author based on Scopus are M. De Onis and P. Svefors. The total number one source article based on Scopus and GS is Plos One. PH Nguyen, P Menon, and VM Aguayo are the three authors who have co-authored the most documents related to stunting in the past decade based on VosViewer visualizations. Based on the results of the VosViewer visualization, six significant clusters were also discussed: review, Inequality, Ethiopia, anemia, trial, and Infant.
Conclusions: Stunting prevention in areas or countries with acute stunting needs more detail from governments and WHO. We recommend that future research on the pattern of appropriate policies to prevent stunting be carried out.

INTRODUCTION

According to WHO[1], stunting is a growth and development problem in children caused by chronic malnutrition and frequent illnesses, defined as their shorter or taller than average. Furthermore, the World Health Organization[2], stunting is short or very short based on length/height for age which is less than -2 standard deviations (SD) on the WHO growth curve, which occurs due to irreversible conditions due to inadequate nutritional intake and repeated infections/ chronic disease that occurs within 1000 HPK. Childhood stunting is a significant barrier to human growth, impacting roughly 162 million children under five worldwide. A height over two standard deviations below the World Health Organization (WHO) child development standards median is considered stunting [3].

It is the permanent result of poor Nutrition and numerous bouts of infection throughout a child's first 1000 days of life. Stunting has long-term consequences for people and communities, such as impaired cognitive and physical development, decreased productive capacity, poor health, and an increased risk of degenerative illnesses such as diabetes[4]. If current trends continue, 127 million children under five will be stunted by 2025. As a result, further funding and action are required to meet the International Health Assembly's 2025 aim of decreasing the current number to 100 million.

Researchers and policymakers must have a comprehensive picture of the global stunting situation for the right actions to be taken. There have been several studies on bibliometric analysis related to stunting, namely the bibliometric analysis of the government policy on a stunting intervention based on Science Direct data from 2012 to 2022 [5]. Komedi's research is already good because it proposes recommendations for the lack of policy intervention research. However, Komedi did not describe each cluster in detail and was limited to the 55

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publications investigated. Furthermore, Novi Yulianti conducted a bibliometric analysis of 200 articles based on Google Scholar (GS) data from 2018 to 2022 [6]. Novi Yulianti's research only uses 200 articles from GS, even though through Publish or Perish you can get a maximum of 1,000 articles from GS. Next, Ijaiya conducted a bibliometric analysis regarding Childhood Malnutrition in Africa based on Pubmed data from 1999 to 2019 in the PubMedR package application [7]. Furthermore, Saputra conducted a bibliometric analysis of 994 articles on Public Administration on stunting problems from GS or Scopus-indexed journals from 2017-2022 [8]. However, there is no bibliometric analysis related to stunting globally and simultaneously using metadata from GS and Scopus on Vosviewer visualization from 2012 to 2022.

The aim of this study is to investigate the trends in research on stunting through a bibliometric analysis of the widely used GS and Scopus databases. Thus, this paper focuses on research trends in stunting from 2012-2022 with seven main research questions: i) What is the output of stunting publications in the recent decade?; ii) How widely are stunting papers distributed worldwide across nations and institutions?; iii) Who was the first place of the author of Stunting Globally?; iv) What is the clustering of stunting publications based on the title of the source?; v) How does the authorship interact with the main trends of stunting research?; vi) How can the results of stunting research trends be illustrated?; and vii) What are the implications for future stunting research?.

METHODS

This study provides a useful reference experience on time-ahead research using a literature study through bibliometric analysis of the paper[9–11]. In academic research, it is essential to gain a new, more comprehensive perspective from the research that has been done on relevant and current content. Bibliometric analysis tools will help direct research around the world[9,12–14]. This bibliometric analysis stage adopts the Prisma protocol[10], namely (i) opening Harzing's PoP application on 31 May 2023 by entering the word "stunting" in the title words menu and keywords "stunting," "childhood," "intervention" in the keywords menu section of Google undergraduate search; to get metadata from Scopus databases, we change Preferences from GS to Scopus search, at this stage the researcher must enter the Application Programming Interface (API) key from the Elsevier developers web site and also enter the exact words to title and exact keywords as GS; (ii) determine the specific desired year range, in this study the range was chosen from 2012 to 2022. (iii) The findings are saved as Comma Separated Values (CSV) and Research Information System (RIS) for saving metadata by choosing the appropriate format; (vi) moreover, reducing the number of articles in the CSV metadata from 992 to 849 that satisfy specific requirements, such as the publication year 2012–2022 range, the language used—English—and other factors such as document type and field of study; (v) feasibility, specifically looking over 849 papers carefully, paying attention to the citations, authors, titles, abstracts, and source titles; (vi) eligibility stage, At this point, Eight hundred forty-nine documents satisfied the standards because the document type and subject area were not restricted; (vii) utilize the VosViewer program to display the RIS metadata. At this point, we use bibliographical data to generate maps that show co-authorship and citations. Next, develop a text-based map to view co-occurrence maps of titles, words, keywords, and abstracts. During this visualization phase, the RIS metadata files from GS and Scopus are picked concurrently to generate a map in VosViewer. Exploration was conducted to explore research patterns, such as research output, paper source, country and organization spread across the globe, productivity distribution in subject categories, first-place authors, top citations, and research trends. The VoSViewer application was used to discover study trends in stunting[15].

DISCUSSIONS

Figure 1 below shows the number of studies related to stunting based on Scopus and google scholar (GS) databases from 2012 to 2022.

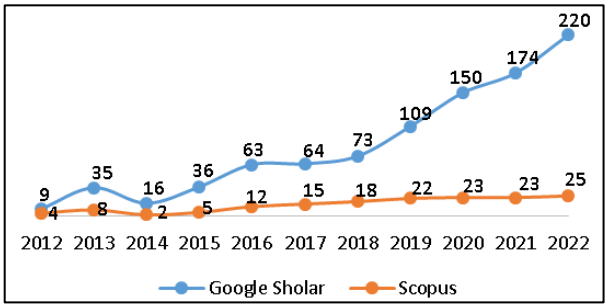

Figure 1. The trend of stunting research from 2012-2022 based on GS and Scopus

There are 849 search documents from GS related to stunting throughout the year on widespread and open access, and 157 documents from the Scopus database using publish or perish. Based on Scopus and GS databases, the quantity of copies of stunting from 2012 to 2022 has increased. Based on the trendline of the data in Figure 1, We can predict the total of curbing documents on the GS database at more than five times more than Scopus Documents. Table 1 below shows the top five authors based on the number of documents from GS worldwide from 2012 to 2022.

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Table 1. Top authors most cited based on Scopus and GS database

No.	Authors	Source	Cites in Scopus	Cites in GS*
1	Prendergast & Humphrey [16]	Pediatrics and International Child Health	476	1041
2	De Onis et al.[17]	Public Health Nutrition	332	
3	Hoddinott et al. [18]	Maternal and Child Nutrition	245	
4	Danaei et al. [19]	PLoS Medicine	228	
5	De Onis et al. [20]	Maternal and Child Nutrition	218	
6	de Onis & Branca[21]	Maternal &Child Nutrition		1338
7	Wessells & Brown [22]	PloS one		1065
8	Stewart, et al. [23]	Maternal &Child Nutrition		781
9	WHO [1]	World Health Organization		703

*GS = Google Scholar

Table 1 shows the top five authors most cited based on Scopus, namely Prendergast & Humphrey (476), De Onis et al. (332), Hoddinott et al. (245), Danaei et al. (228), De Onis et al. (218). The paper that is in the first place that is most cited is the one written by Prendergast & Humphrey. But overall, De Onis et al. have the most accumulation of citations, namely 550, because it ranks second and fifth in Table 1. Table 1 also shows the top five authors most cited based on GS, namely de Onis & Branca (1338), Wessells & Brown (1065), Prendergast & Humphrey (1041), Stewart, et al. (781), WHO (703). The most cited paper in the first place is the one written by de Onis & Branca. Table 1 and Table 2 show that the slice is only one article that is in Scopus metadata (Table 1) as well as in GS data (Table 2), namely Prendergast and Humphrey [16]. this finding contradicts what has been done by Saputra, who conducted a bibliometric analysis on 994 GS and Scopus-indexed documents[8].

Table 2. Top seven productive authors base on GS

No.	Author(s)	Origin	Total Documents
1	T Siswati	Indonesia	7
2	M Shekar	United States	6
3	P Svefors	Sweden	6
4	AM Prentice	United States	4
5	JL Leroy	United States	4
6	T Huriah	Indonesia	4
7	T Sipahutar	Indonesia	4

Table 2 shows the Top seven productive authors base on GS, namely T Siswati et al., seven articles; M Shekar et al. and P Svefors, six articles each. Four authors and co-authors have four papers on stunting: AM Prentice et al., JL Leroy et al., T Huriah et al., and T Sipahutar et al. Table 3 implies that in accumulation, Indonesia dominates with a contribution of 15 articles related to stunting, followed by the United States with 14 articles. While the top five productive authors based on Scopus are M. De Onis and P. Svefors, each with three documents, the rest are G.N. Khan, J.H. Rah, and J.R. Khan, each contributing two articles related to stunting. In addition, the authors who have published two papers on Scopus are L. Huicho from Peru, M. Shekar from the US, O. Cumming from the UK, R. Pearson from Australia, and S.K. Mistry from Bangladesh.

Table 3. Top five source articles based on Scopus

No.	Source	Total Documents
1	PLoS ONE	18
2	Maternal and Child Nutrition	12
3	BMC Public Health	10
4	BMC Nutrition	6
5	Nutrition	6
6	Public Health Nutrition	6
7	BMC Pediatrics	5

Table 3 shows the top seven source articles based on Scopus: PLoS ONE, Maternal and Child Nutrition, BMC Public Health, BMC Nutrition, Nutrition, Public Health Nutrition, and BMC Pediatrics. Meanwhile, the top seven source articles based on GS are Plos One (46 documents), Maternal & Child Nutrition (36 papers), BMJ Global Health (32 papers), Nutrition (23 documents), Public Health Nutrition (15 documents), American Journal of

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Clinical Nutrition (14 documents), and The Journal of Nutrition (13 papers). From the top seven source articles based on Scopus, three source titles are also included in the top seven articles based on GS: PLoS ONE, Nutrition, and Public Health Nutrition. However, PLoS ONE is the number one source title on Scopus and GS metadata.

Trend analysis of the distribution of research documents, most influential authors, and most contributed journals on the topic of stunting using Comma Separated Values (CSV) data. However, Visualization of shared stunting uses the Research Information System (RIS) metada. Base on the visualization of Co-authorship and citation, PH Nguyen, P Menon, and VM Aguayo are the three authors who have the most joint authorship documents related to stunting in the last decade (2012-2022).

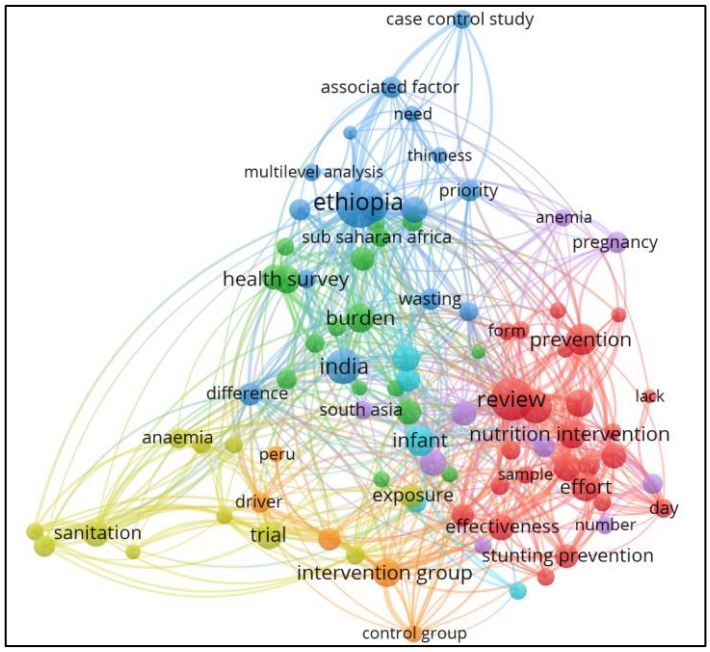

Figure 2. Whole picture of the stunting database on GS and Scopus

Visualization of RIS metadata taken from two sources, i.e. Google Scholar and Scopus, using the PoP application. Visualization is conducted by simultaneously inserting two RIS files from Scopus and GS using the VosViewer application[24,25]. If we zoom out on Figure 2, it will be apparent that there have been seven stunting research clusters. However, only six significant groups discussed Review, Inequality, Ethiopia, anemia, trial, and Infant. Figure 3 through 5 explain each cluster.

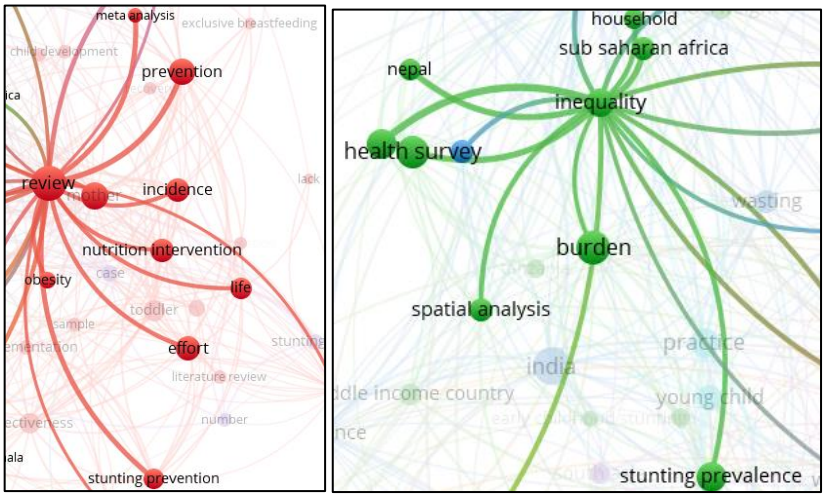

Figure 3. Cluster one (red keywords) and Cluster two (green keywords)

Cluster one (red colour) in Figure 3 relates to review, prevention, meta-analysis, mother, incidence, nutrition intervention, effort, life, obesity, exclusive breastfeeding, and stunting prevention. Some of the results of cluster one research related to the review, namely, stunting prevention and control initiatives to minimize malnutrition prevalence[26]. The Social-cultural aspect of stunting [27], Sub-Saharan Africa's food shortages, dietary diversity, and stunting [28]. Examples of stunting research related to prevention are variables

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influencing health cadres' Comprehension and Drive in stunting mitigation amongst Children in Indonesia [29] and Determinants of stunting prevention among mothers with children aged 6–24 months [30]. Examples of stunting research related to mothers are the father's assistance and the mother's actions in stunting mitigation attempts[31], [32] and Stunting risk factors range from pregnant women to a youngster below 59 months[33]. An example of incidence-related stunting research is the maternal cause of malnutrition in South Sumatra[34].

According to cluster one, we can say that stunting can be prevented in several ways: nutrition intervention and exclusive breastfeeding. Research results on stunting prevention using nutrition intervention include the Family Empowerment Model [35] and Nutrition intervention for children aged 0 to 59 months[36]. In a low-income society, examples of research results on stunting prevention using exclusive breastfeeding. Exclusive breastfeeding protects early infants against stunting [37], the association between exclusive breastfeeding and stunting in toddlers[38], stunting, anemia, and exclusive breastfeeding prevalence disparities in African children[39], and breastfeeding exclusively to reduce stunting in toddlers [40,41]. If stunting is not prevented, it will have a long-term impact on the lives of children who are stunted. An example of research into the effects of stunting on life is the long-term consequences of stunting in early life [42]. In addition, there is research on stunting related to obesity, namely Brazilian adolescents' socioeconomic determinants for overweight and stunting [43] and being overweight and stunting coexist with the prevalence and related variables in Ethiopian children under five [44]. An example of stunting research related to Exclusive breastfeeding is nursing exclusively to reduce stunting in kids[40].

Cluster two (green colour) in Figure 4 is related to inequality, burden, stunting prevalence, household, health survey, Nepal, and sub-Saharan Africa. Cluster three revolves around stunting due to injustice and low-income household conditions. For example, aflatoxin's health impact is attributed to stunting among children in low-income African countries[45]. Stunting also occurs due to geographical conditions that are difficult to reach, for example, India's geographical burden of stunting [46], and also due to the effect of natural catastrophes on child stunting in Nepal [47]. The next cause of stunting is socioeconomic inequality in stunting among children under the age of five [48]. According to WHO, 22.0% of all children under five years were stunted in 2020 [2]. Therefore, stunting must be stopped by improving child feeding, women's Nutrition, and household sanitation [49]. One explanation for the 22% number is that the burden causes and overlaps with stunting are overlooked, according to an analysis of nationally representative cross-sectional demographic and health surveys from six countries[50].

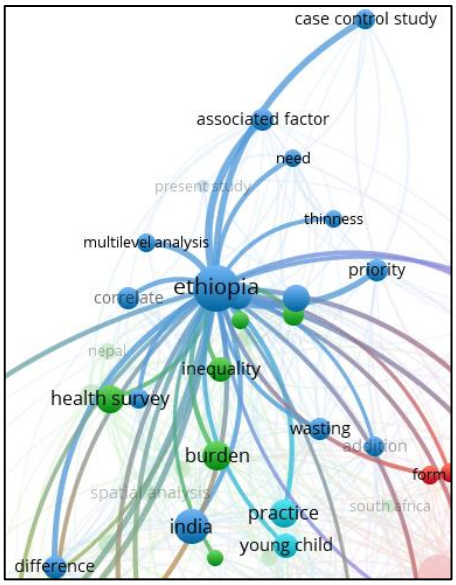

Figure 4. Cluster three (blue dodger keywords)

Cluster three (dodger blue) in Figure 4 is related to Ethiopia, correlation, multilevel analysis, associated factor, case-control study, need, thinness, priority, wasting, India, and difference. Sociocultural and economic conditions determine stunting and thinness[51]. In addition, wasting is associated with stunting[52]. Other factors that influence the incidence of stunting are rarely washing hands, consuming dirty water, and the absence of toilet facilities [53]. Stunting also correlates with diarrhea and urban and rural areas[54,55]. Wasting and stunting-similarities and differences interventions. Instead of focusing on one or the other kind of malnutrition, treatment treatments should target children who are both wasting and stunted and have the most severe deficiencies in muscle mass. Interventions should also target early babies and children with poor muscle mass relative to their body weight[56]. Stunting management requires priority intervention, such as partitioning around medoids clusters for stunting study in 100 priority regencies in Indonesia [57].

Furthermore, several examples of stunting incidents occurred in Ethiopia and India. Findings from India showed the impact of pregnancy intent, postnatal depression symptoms, and social support on child

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stunting [58]. In Ethiopia, the predictors of childhood stunting in children under five years include child health indicators, the mother's nutritional condition, educational level, and environmental cleanliness. In addition, non-receipt of breastmilk, mother's overweight, work level, and higher family affluence were all related to a lower risk of stunting in Ethiopia. At the same time, enablers included inhabitants of "arid" geographic locations, the child's tiny birth size, and the mother's underweight[59,60].

To deal with acute stunting necessary to involve many parties. For example, it identifies the causes of stunting [61] and prioritizes interventions for stunting [62]. In addition, to facilitate stunting literacy in critical editing areas, it is necessary the application of technological developments to comprehend a problematic health issue [63].

Cluster 4 (yellow colour) in Figure 2 is related to the trial, control, exposure, Pakistan, anemia, cluster, environmental enteric dysfunction, sanitation, water, and hygiene. An example of trial-related stunting research is a randomized maternal education trial's six-year follow-up about education concerning Nutrition, hygiene, and child stimulation [64]. According to this cluster, the causes of stunting and anemia are food insecurity in the home and dietary restrictions diversity[65]. Other causes of stunting are Environmental enteric dysfunction and growth failure in global child health [66], rural Ethiopia's water, sanitation, and hygiene[67], and rural India's household sanitation and personal hygiene habits[68]. Furthermore, research on improved water, sanitation, and hygiene and increased supplemental feeding on child stunting and anemia[69] showed that reduced child stunting is connected with improved sanitation[70]. In addition, providing Food supplements reduces stunting in Pakistan[71]. Figure 5 below is an overview of cluster five and six.

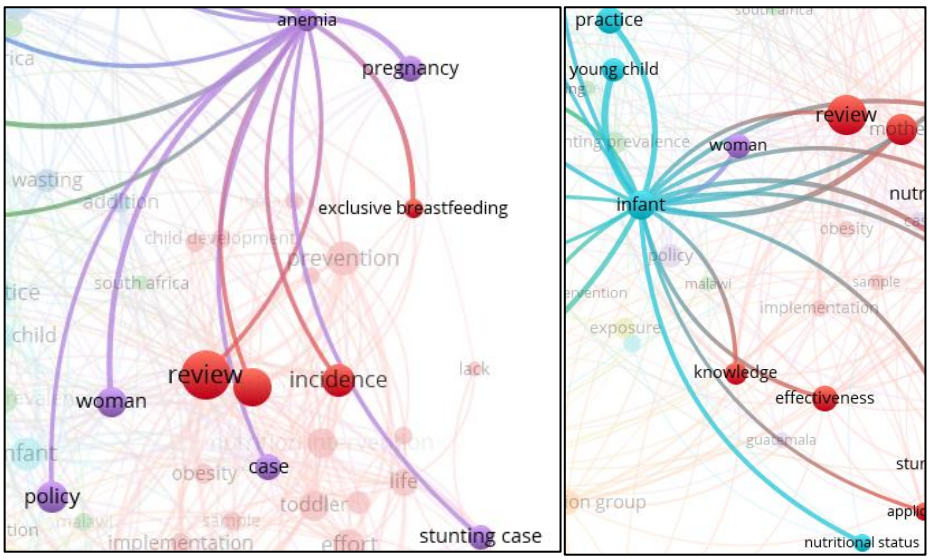

Figure 5. Cluster five (purple keywords) and Cluster six (deep sky-blue keywords)

Cluster 5 (purple) in Figure 5 is related to anemia, policy, pregnancy, stunting cases, and women. According to cluster five, due to early mother age at first birth (18), short birth intervals, and high birth orders, the rates of child stunting and anemia rose[72]. Furthermore, stunting of infants under the age of two is caused by multiple births among young moms[73]. To prevent stunting necessary to implement a stunting prevention policy as a kind of legal protection for children's health rights[74] and prevent stunting in pregnant women via education and Nutrition [75,76]. Stunting prevention must align with WHO policies[1].

Cluster 6 (deep sky blue) in Figure 5 relates to the infant, young child, practice, and nutritional status. One failure to optimize child-feeding habits is one of the reasons for stunting[77]. Examples of research on infants are stunting babies connected with gestational age, exclusive breastfeeding, and attitude supplementary meals[78]. Furthermore, Mothers' Nutritional education prevents stunting among young children [79].

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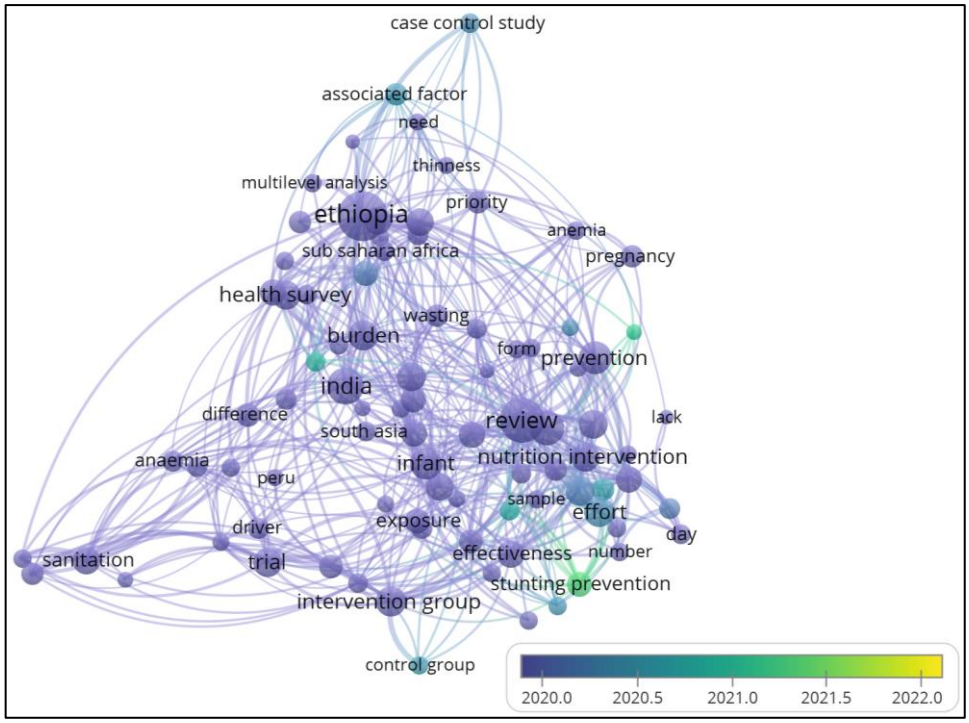

Figure 6. Research novelty in researching stunting in three years (2020-2022)

Figure 6 above shows that the most stunting research occurred in 2020. However, there are only four recent research keywords related to stunting in 2021: stunting prevention, exclusive breastfeeding, spatial analysis, and implementation. Meanwhile, in 2022 there will be no current research on stunting based on the Scopus and GS databases. In addition, the picture above provides a new perspective for researchers that research about stunting is urgently needed. For example, stunting prevention in acute locations such as Ethiopia, India, and Nepal. Specifically in Indonesia, stunting prevention can be prioritized in areas with stunting rates above 20% [80]. Furthermore, we recommend that future research on the pattern of appropriate policies to prevent stunting be carried out. In addition, research on stunting treatment for children who are already stunted is also highly recommended.

CONCLUSIONS

Based on the results and discussion, we can conclude that the authors most cited based on the Scopus database are Prendergast & Humphrey. The authors most cited based on the GS database is de Onis & Branca. The productive author based on GS is T Siswati from Indonesia. At the same time, the top numbers one influential author based on Scopus are M. De Onis and P. Svefors. Next, the Top number one source article based on Scopus and GS is Plos One. PH Nguyen, P Menon, and VM Aguayo are the three authors who have co-authored the most documents related to stunting in the last decade based on VosViewer visualizations. Based on the results of the VosViewer visualization, six significant clusters were discussed: review, inequality, Ethiopia, anemia, trial, and infant. Based on the Scopus and GS databases in the last decade, especially in 2022, no significant recent studies related to stunting exist. Highly recommended stunting research is stunting prevention in areas of acute stunting, such as in Ethiopia, India, and Nepal. Furthermore, we recommend that future research on the pattern of appropriate policies to prevent stunting be carried out. In addition, research on stunting treatment for children who are already stunted is also highly recommended.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

All authors haven't conflict of interest in this article. This research is self-funding.

AUTHOR CONTRIBUTIONS

YND: conceptualization, data curation, formal analysis, investigation, methodology and writing-review & editing; MPNH: validation, visualization, and editing; AP: supervision and editing.

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