JPPIPA 9(Special Issue) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Research Trends of Stunting Related to Insulin-Like Growth Factor-1: Bibliometric Analysis

Lukman Hardia[1*], Agus Sangka Pratama[2], A. M. Muslihin[3]

[1] Pharmacy Study Program, Muhammadiyah Education University of Sorong, Sorong, Indonesia
[2] Pharmacy Study Program, Makassar Islamic University, Makassar, Indonesia
[3] Pharmacy Study Program, Muhammadiyah Education University of Sorong, Sorong, Indonesia

Received: October 30, 2023
Revised: November 29, 2023
Accepted: December 25, 2023
Published: December 31, 2023

Corresponding Author:
Lukman Hardia
lukman@unimudasorong.ac.id

DOI: 10.29303/jppipa.v9iSpecialIssue.6903

© 2023 The Authors. This open access article is distributed under a (CC-BY License)

Abstract: Stunting is a condition in which a person's height is less than normal based on age and gender. The prevalence of stunting in Indonesia in 2021 is 24.4%. This illustrates that stunting is still a problem that cannot be resolved in Indonesia. Research on the incidence of stunting was carried out to determine its relationship with insulin-like growth factor-1 (IGF-1) levels. Search results on the Pubmed database obtained 446 English-language articles published from 1993 – April 12, 2023. The results of bibliometric analysis and VOSViewer show that new research trends began to be seen in 2018 to 2023 even though there had been publications previously in 1993 and 2000, but very minimal amount. The most dominating document types were journal articles with 310 publications (69.51%) and reviews with 89 publications (19.96%). The most trending keywords are humans (268), female (176), male (145), animals (142), insulin-like growth factor i/metabolism (94), child (74), adult (60), mice (56), pregnancy (47) and child preschool (43). The publishing journals that published the most articles were Frontiers in Endochronolgy (22 publications), International Journal of Molecular Sciences (19 publications), Scientific Reports (13 publications). The highest number of author collaborations is from the USA with 78 articles being the country with the most collaboration on both SCP and MCP with an MCP to SCP ratio of 0.244. China ranks second with the number of articles of 63 with an MCP ratio of 0.190.

Keywords: VosViewer; Bibliometric; Stunting; Insulin-Like Growth Factor-1; IGF-1

Introduction

Stunting is a condition where a person's height is less than normal based on age and gender, which indicates a condition of malnutrition (Candra, 2020). The national prevalence of stunting among children under five in Indonesia in 2021 is 24.4%, this prevalence shows a decrease compared to 2019 (27.7%) and 2018 (30.8%). The prevalence of stunting was 24.4%, consisting of 5.4% very short (severely stunted) and 19% quite short (moderately stunted). This illustrates that stunting is still a problem that cannot be resolved in Indonesia, so it has become one of the government's priority programs in the SDGs (Rencana Strategis Kementerian Kesehatan Tahun 2020-2024, 2020).

The factors causing stunting are very complex. Apart from poor nutrition in pregnant women which is a direct determinant of stunting, fulfilling nutrition during pregnancy and preventing anemia in pregnant women are also no less important to break the chain of stunting in the future (Wulandari et al., 2021; Wulandari et al., 2022). Growth hormone (GH) has a very important role in controlling human growth and development. GH is produced episodically and reaches its peak at night during sleep and influences growth by stimulating the production of Insulin-like growth factor-1 (IGF-1) in the liver. IGF-1 plays an important role in mediating the

How to Cite:
Hardia, L., Pratama, A.S., & Muslihin, A.M. (2023). Research Trends of Stunting Related to Insulin-Like Growth Factor-1: Bibliometric Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 165–171. https://doi.org/10.29303/jppipa.v9iSpecialIssue.6903

effects of GH and plays a role in the regulation of somatic growth and organ development. IGF-1 levels are a parameter of the average daily GH, but IGF-1 levels do not fluctuate throughout the day like GH. Serum IGF-1 levels increase during the child's growth period and reach a peak at puberty and decrease according to the process (Flora, 2021; Flora et al., 2019, 2021).

Serum IGF-1 levels are very sensitive to changes in nutritional status, both chronic and short-term, so that in children with poor nutritional status and malnutrition, serum IGF-1 becomes low and has an impact on growth and height development, this is because IGF -1 has a key role in the development and growth of skeletal muscle (Bartell et al., 2020; Flora et al., 2021).

Various studies were conducted to determine the effect of IGF-1 on the incidence of stunting. This is done to provide information regarding preventive measures and appropriate therapeutic mechanisms to deal with stunting incidents. A bibliometric analysis of stunting research related to a decrease in IGF-1 was carried out to observe whether the research topic was still an interesting issue to pursue. Study information about the incidence of stunting caused by a decrease in IGF-1 levels is presented in the form of bibliographic data. VOSViewer bibliometric analysis is a solution for researchers, academics and the general public because it presents a publication database in the form of a visualization or map so that it is easier to manage and becomes a useful source of knowledge (Hardia & Muslihin, 2023; Khuluq et al., 2022). Such as presenting research keywords in visual form, distribution of article author affiliations based on countries, agencies and international collaborations. Bibliometric analysis methods and VOSViewer are used as retrospective sources for scientific journals (Yuliyanto et al., 2023).

Method

Literature Search

Data obtained from the Pubmed database (pubmed.gov) which was downloaded on April 12 2023. The search terms used were Insulin-Like Growth Factor-1[Title] OR IGF-1[Title] AND Stunting Factor [Title] AND Stunting [Title] with a search period of 30 years starting from 1993 to 2023 and documents in English. Searching the Pubmed database resulted in 446 study documents in Pubmed.txt format. The data obtained was then analyzed using VOSviewer software (version 1.6.17) which was used to map writing, total number of publications, number of publications cited and the bibliometrix analysis web-interface application (version 2.0. https://www.bibliometrix.org/Biblioshiny.html) accessed using R-Studio.

Data Collection

Data obtained from the Pubmed database (pubmed.gov) which was downloaded on April 12 2023 with a search period of 30 years starting from 1993 to 2023 by filtering English language documents. The results of the search on the Pubmed database obtained 446 study documents which were then analyzed using bibliometrics and all processes were carried out with Biblioshiny which was accessed using the R-Studio application.

Result and Discussion

Publication Trends

Table 1. Publication trends about stunting and IGF-1 (1993 – 2023)

Year	Articles
2021	106
2022	100
2020	86
2019	77
2018	49
2023	23
2000	3
1993	2
1994	0
1995	0

During the period 1993 to 2023, 446 study documents were obtained from the Pubmed database related to stunting and IGF-1 in English. The publication trend started in 1993 with 2 publications and in 2000 with 3 publications. After 1993 and 2000, publication trends were no longer found in publication data, new publication trends began to appear again and continued to increase in 2018 with the number of publication documents amounting to 49 publications, this trend continues to increase every year with the highest publication trend in 2021, amounting to 106 publications. The data is up to 2022 **(Table 1.)** while 2023 is still in the current year with data collection on April 12 2023. The increasing publication trend in the last 5 years shows that research discussing stunting and IGF-1 is still very interesting to discuss.

Most Types of Published Documents

Table 2. Top 10 of types published document

Document Type	Result	%
Case reports	23	5.16
Clinical trial	10	2.24
Comment	2	0.45
Comparative study	3	0.67
Editorial	2	0.45
Evaluation study	3	0.67
Journal article	310	69.51
Letter	1	0.22
Review	89	19.96
Others	3	0.67

In total, 446 publications were obtained from the Pubmed database. 446 articles published in 1993 were analyzed, which included 310 (69.51%) journal articles, 89 (19.96%) reviews, 23 (5.16%) case reports, 10 (2.24%) clinical studies, and other forms of publication, including commentaries, comparative studies, editorials, letters. The language of all publications is English. Complete details can be seen in (**Table 2**.). Several types of publication articles such as Clinical Characteristics and Long-Term Recombinant Human Growth Hormone Treatment of 18q- Syndrome: A Case Report and Literature Review (Liu et al., 2021), Xanthomatous Hypophysitis: A Case Report and Comprehensive Literature Review (Zhu et al., 2021) and Case report: Treatment of psychiatric symptoms for an acromegalic patient with pituitary adenoma (Shi et al., 2022).

Countries and Agencies with the Most Publications

Table 3. Correspondence based on author's country

Countrys	Articles	Freq.	SCP	MCP	MCP Ratio
USA	78	59	19	0.175	59
China	63	51	12	0.141	51
Japan	22	20	2	0.049	20
Poland	21	18	3	0.047	18
Spain	15	13	2	0.034	13
Germany	14	9	5	0.031	9
Korea	14	11	3	0.031	11
Netherlands	13	8	5	0.029	8
Canada	12	6	6	0.027	6
Italy	12	9	3	0.027	9
Brazil	11	8	3	0.025	8
France	8	5	3	0.018	5
New Zealand	6	5	1	0.013	5
Autralia	5	5	0	0.011	5
Egypt	5	4	1	0.011	4
India	5	5	0	0.011	5
Iran	5	3	2	0.011	3
Israel	5	2	3	0.011	2
Sweden	5	1	4	0.011	1
Switzerland	5	3	2	0.011	3
UK	5	4	1	0.011	4
Indonesia	4	3	1	0.009	3
Chile	3	2	1	0.007	2
Czech Rep.	3	2	1	0.007	2

Table 3. provides an overview of the collaborations of the top 24 authors by country which are divided into two types of articles, namely SCP (Single Country Publication), namely publications that represent collaboration between countries, but all authors come from only one country and MCP (Multiple Country Publication), namely publications representing collaboration between countries and all authors come from different countries (Yuliyanto et al., 2023).

The results of the bibliometric analysis of the database from 1993 to April 12 2023 show that the highest number of author collaborations is from the USA with 78 articles, being the country with the most collaborations for both SCP and MCP with an MCP to SCP ratio of 0.244. China ranks second with the number of articles of 63 with an MCP ratio of 0.190. The third place is occupied by Japan with a total of 22 articles and an MCP ratio of 0.9. Poland ranks fourth with a total of 21 articles and an MCP ratio of 0.143. If you look at the MCP ratio, Poland collaborates more with other countries than Japan. Overall, the country with the largest MCP ratio is Sweden with an MCP ratio of 0.800, which means that Sweden is the country with the largest number of collaborations with other countries, in second place is Israel with an MCP ratio of 0.600 and in third place are Iran and Switzerland with an MCP ratio of 0.400.

Indonesia ranks 22nd with a total of 4 publications, an SCP value of 1, an MCP of 0.009 and an MCP ratio of 0.250. This also shows that from Southeast Asia, only Indonesia is included in the list of the top 24 with the highest number of contributions and collaborations in publications about stunting and IGF-1. It is hoped that in the future there will be more contributions and collaborations in Indonesia to write articles discussing the link between stunting and IGF-1 as has been done by previous researchers (Flora et al., 2021; Putri, 2021).

Table 4. Collaboration between countries

From	To	Frequency
USA	Canada	13
China	USA	12
USA	Italy	9
USA	Sweden	8
USA	France	7
USA	Japan	7
USA	Denmark	6
USA	Australia	5
USA	Brazil	5
USA	Netherlands	5

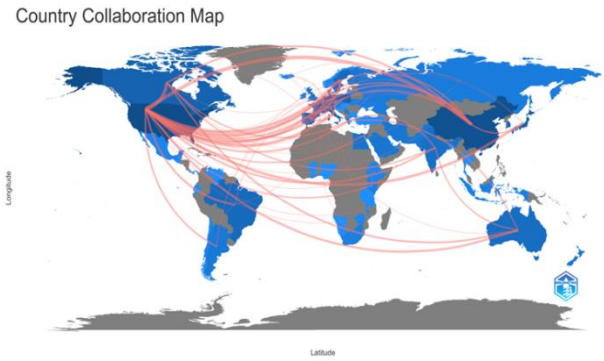

Figure 1. Visualization of the distribution of collaboration between countries based on the number of collaboration frequencies.

Author collaboration between countries is dominated by the USA, although in terms of productivity, China remains the most productive country, but in terms of collaboration this is not the case. Collaboration between countries (Table 3 and Figure 1) is still very dominantly carried out by countries in America and Europe. This shows that the partnership between countries in America and Europe has a very strong partnership in terms of collaborative research on stunting and IGF-1, although China is still at the top, both in terms of countries and authors regarding the quantity of publications.

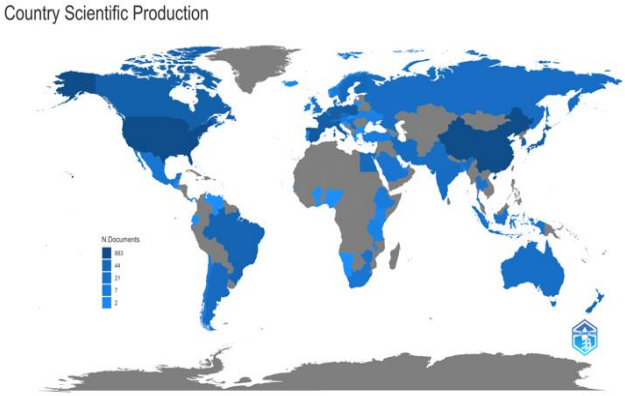

Figure 2. Top 10 countries with the most publications

Table 5. Top 10 countries with the most publications

Countrys	Frequency
China	883
USA	877
Spain	249
Poland	194
Japan	163
Italy	159
Germany	148
France	141
Canada	122
South Korea	103

Table 5. and Figure 2. show the top 10 countries by frequency of scientific article production. China occupies the top spot with a frequency of 883 times, followed by the USA with 877, next are other countries such as Spain (249), Poland (194), Japan (163), Italy (159), Germany (148), France (141), Canada (123) and South Korea (103). This is very relevant when looking at (Table 6 and Figure 3), where authors from China dominate in terms of productivity in publishing articles related to stunting and IGF-1.

Publisher sources with the most article publications

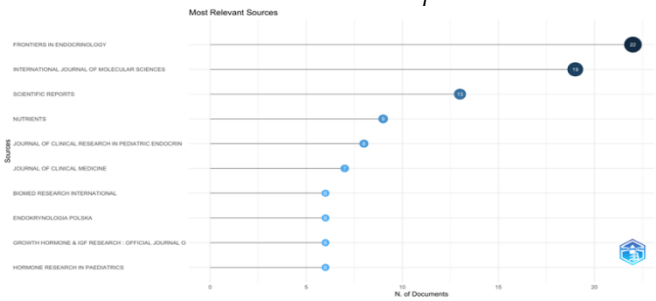

Figure 3. Top 10 Publisher sources with the most article publications

The publishers that published the most articles related to stunting and IGF-1 from 1993 – 2023 are featured in the list of the top 10 publishers with the highest number of publications, including Frontiers in Endocronolgy (22 publications), International Journal of Molecular Sciences (19 publications), Scientific Reports (13 publications), Nutrients (9 Publications), Journal of Clinical Research in Pediatric Endoctrin (8 publications), Journal of Clinical Medicine (7 Publications), Biomed Research International (6 publications), Endokrynologia Polska (6 publications), Growth Hormone & Research : Official Journal (6 publications) and Hormone Research in Pediatrics (6 publications) (**Figure 3.).** The journal Frontiers in Endocronolgy published articles about stunting and IGF-1, some of which are articles discussing growth hormone deficiency and treatment in children who are cancer survivors (Pollock & Cohen 2021), Insulin-Like Growth Factor-1Down-Regulates the Phosphorylation of FXYD1 and Rescues Behavioral Deficits in a Mouse Model of Rett Syndrome (Yuan et al. 2020), Diagnostic Value of a Combination of Serum Brain-Derived Neurotrophic Factor and Insulin-Like Growth Factor-1 for the Efficacy of Diagnosis and Treatment of Major Depressive Disorder (Troyan & Levada, 2020) and PM2.5 induces reduced lifespan, impaired insulin/IGF-1 signaling pathway and impaired lipid metabolism in Caenorhabditis elegans (Mahmud Reza et al., 2023).

Author of the most articles

Table 6. Top 10 authors with the most articles

Author	Number of published articles
Zhang Y	14
Wang Y	11
Hwa V	10
Dauber A	9
Chen S	7
Li C	7
Li X	7
Wang Z	7
Chen L	6
Li J	6

The top 10 authors with the highest number of published articles are Zhang Y with 14 articles, Wang Y with 11 articles, Hwa V with 10 articles, Dauber A with 9 articles, Chen S, Li C, Li X, Wang Z with 7 each. articles, and Chen L and Li J each published 6 articles. Several publications from 10 authors with the highest number of articles are Association Between the Growth Hormone/Insulin-Like Growth Factor-1 Axis and Muscle Density in Children and Adolescents of Short Stature (Yang et al., 2022), Association between Growth Differentiation Factor-15 and Risk of Cardiovascular Diseases in Patients with Adult Growth Hormone Deficiency (Wu et al., 2021), Protein QTL analysis of IGF-I and its binding proteins provides insights into growth biology (Bartell et al., 2020), and Association Between the Growth Hormone /Insulin-Like Growth Factor-1 Axis and Muscle Density in Children and Adolescents of Short Stature (Yang et al., 2022).

Topic Analysis Based on Keywords Used by the Author

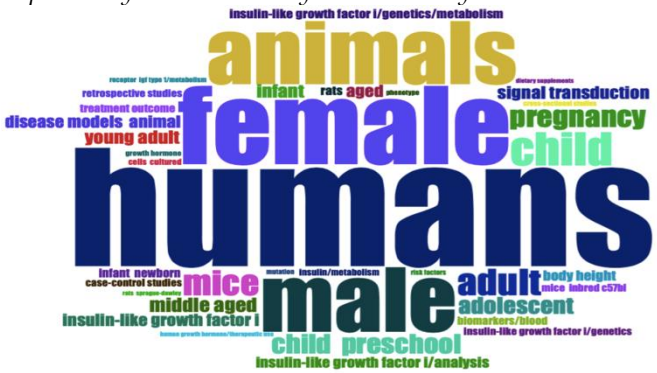

Figure 4. keywords that are often used in article publications

The results of keyword analysis using bibliometrics found 4548 keywords which provide important information about the dynamics of the scope and issues that are much larger than this research (Table VII and Figure 8). From a total of 4548 keywords used, the results of bibliometric analysis and VOSViewer show that the more often two keywords are paired, the closer the relationship between the two keywords will be. Bibliometric analysis **(Figure 4)** shows that the more frequently keywords are used, the greater the appearance of the font size that appears. Based on the results of keyword analysis using bibliometric analysis **(Figure 4)**, it shows that the dominant keywords used by the author for the topic of stunting in relation to IGF-1 include humans (268), female (176), male (145), animals (142), insulin -like growth factor i/metabolism (94), child (74), adult (60), mice (56), pregnancy (47) and child preschool (43). Several articles use the keywords (humans, female, male, animals, insulin-like growth factor i/metabolism, child, adult, mice, pregnancy, child preschool, namely the role of serum growth hormone and insulin-like growth factor-1 in adult human brain morphology (Yuan et al., 2020), the overexpression of insulin-like growth factor-1 and neurotrophin-3 promote functional recovery and alleviate spasticity after spinal cord injury (Talifu et al., 2022), and the growth hormone–insulin -like growth factor-I axis in the diagnosis and treatment of growth disorders (Blum et al., 2018).

Conclusion

The trend of publishing articles about the incidence of stunting in relation to IGF-1 was first carried out in 1993, but a visible increase only started to trend in 2008. This shows that this topic is becoming an increasingly interesting issue for writers to research. China and the USA are countries with the number of authors and quantity of scientific article publications that dominate compared to other countries. The prevalence of stunting in Indonesia is still above WHO standards and makes the issue of stunting part of the SDGs actually very potential, especially considering the large number of university institutions. High who has expertise in the field of research to increase scientific publications regarding the relationship between stunting and IGF-1 as part of finding solutions to handling stunting in Indonesia.

Acknowledgments
The author would like to thank the Institute for Research, Publication and Community Service (LP3M) Muhammadiyah University of Education, Sorong, which has provided a letter of assignment to the research team to complete this research.

Author Contributions
The authors of this paper consist of four people, namely L.H, A.S.P, and A.M.M. This article was carried out collaboratively at each stage.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

References

Bartell, E., Fujimoto, M., Khoury, J. C., Khoury, P. R., Vedantam, S., Astley, C. M., Hirschhorn, J. N., & Dauber, A. (2020). Protein QTL analysis of IGF-I and its binding proteins provides insights into growth biology. *Human Molecular Genetics*, *29*(15), 2625–2636. https://doi.org/10.1093/hmg/ddaa103

Blum, W. F., Alherbish, A., Alsagheir, A., El Awwa, A., Kaplan, W., Koledova, E., & Savage, M. O. (2018). The growth hormone-insulin-like growth factor-I

axis in the diagnosis and treatment of growth disorders. In *Endocrine Connections* (Vol. 7, Issue 6, pp. R212–R222). BioScientifica Ltd. https://doi.org/10.1530/EC-18-0099

Candra, A. (2020). Epidemiologi Stunting. In *Fakultas Kedokteran Universitas Diponegoro Semarang* (1:2020, Vol. 1, Issue 1). Fakultas Kedokteran, Universitas Diponegoro.

Flora, R. (2021). *Stunting Dalam Kajian Molekuler*. Unsri Press.

Flora, R., Zulkarnain, M., Alam Fajar, N., Fickry Faisa, A., & Slamet, S. (2019). Kadar Zat Besi Serum Dan Hemoglobin Pada Anak Stunting Dan Tidak Stunting di Kabupaten Seluma. *Prosiding SainsTeKes Semnas MIPAKes UMRi*, *1*, 16–22.

Flora, R.-, Zulkarnain, M.-, Fajar, N. A., Faisa, A. F., Nurlaili, N.-, Ikhsan, I.-, Slamet4, S.-, Tanjung, R.-, & Aguscik, A.-. (2021). Kadar Zinc Dan Kadar Igf-1 Serum Pada Anak Sekolah Dasar Di Kecamatan Tuah Negeri Kabupaten Musirawas. *JPP (Jurnal Kesehatan Poltekkes Palembang)*, *16*(1), 1–6. https://doi.org/10.36086/jpp.v16i1.667

Hardia, L., & Muslihin, A. M. (2023). (MBL) Terhadap Golongan Karbapenem: Analisis Bibliometrik. *Jurnal Etnofarmasi*, *1*(01), 7–16. https://unimuda.e-journal.id/jurnalfarmasiunimuda/article/view/4770/1672

Khuluq, H., Yusuf, P. A., & Perwitasari, D. A. (2022). A bibliometric analysis of coronavirus disease (COVID-19) mortality rate. *Bali Medical Journal*, *11*(2), 579–586. https://doi.org/10.15562/bmj.v11i2.3423

Liu, S., Chen, M., Yang, H., Chen, S., Wang, L., Duan, L., Zhu, H., & Pan, H. (2021). Clinical Characteristics and Long-Term Recombinant Human Growth Hormone Treatment of 18q- Syndrome: A Case Report and Literature Review. *Frontiers in Endocrinology*, *12*. https://doi.org/10.3389/fendo.2021.776835

Mahmud Reza, H., Omar Faruque, M., Rahman, A., & Li, G. (2023). *PM2.5 induce lifespan reduction, insulin/IGF-1 signaling pathway disruption and lipid metabolism disorder in Caenorhabditis elegans*. https://doi.org/10.3389/fpubh.2023.1055175

Rencana Strategis Kementerian Kesehatan Tahun 2020-2024, (2020).

Putri, P. N. (2021). *Insulin-Like Growth Factor-1 (IGF-1) Level Analysis on Children with Short Stature*. Universitas Hasanuddin.

Shi, Z., Cong, E., Wu, Y., Mei, X., Wang, Y., & Peng, D. (2022). Case report: Treatment of psychiatric symptoms for an acromegalic patient with pituitary adenoma. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.1068836

Talifu, Z., Qin, C., Xin, Z., Chen, Y., Liu, J., Dangol, S., Ma, X., Gong, H., Pei, Z., Yu, Y., Li, J., & Du, L. (2022). The Overexpression of Insulin-Like Growth Factor-1 and Neurotrophin-3 Promote Functional Recovery and Alleviate Spasticity After Spinal Cord Injury. *Frontiers in Neuroscience*, *16*. https://doi.org/10.3389/fnins.2022.863793

Troyan, A. S., & Levada, O. A. (2020). The Diagnostic Value of the Combination of Serum Brain-Derived Neurotrophic Factor and Insulin-Like Growth Factor-1 for Major Depressive Disorder Diagnosis and Treatment Efficacy. *Frontiers in Psychiatry*, *11*. https://doi.org/10.3389/fpsyt.2020.00800

Wu, X., Wang, Y., Ren, Z., Li, L., Qian, W., Chen, Y., & Ren, W. (2021). Association between Growth Differentiation Factor-15 and Risk of Cardiovascular Diseases in Patients with Adult Growth Hormone Deficiency. *International Journal of Endocrinology*, *2021*. https://doi.org/10.1155/2021/5921863

Wulandari, E. C., Wijayanti, H. S., Widyastuti, N., Panunggal, B., Ayustaningwarno, F., & Syauqy, A. (2021). Hubungan Stunting Dengan Keterlambatan Perkembangan Pada Anak Usia 6-24 Bulan. *Journal Of Nutrition College*, *10*(4), 304–312. http://ejournal3.undip.ac.id/index.php/jnc/

Wulandari, R. D., Laksono, A. D., Kusrini, I., & Tahangnacca, M. (2022). The Targets for Stunting Prevention Policies in Papua, Indonesia: What Mothers' Characteristics Matter? *Nutrients*, *14*(3). https://doi.org/10.3390/nu14030549

Yang, G., Yang, Q., Li, Y., Zhang, Y., Chen, S., He, D., Zhang, M., Ban, B., & Liu, F. (2022). Association Between the Growth Hormone/Insulin-Like Growth Factor-1 Axis and Muscle Density in Children and Adolescents of Short Stature. *Frontiers in Endocrinology*, *13*. https://doi.org/10.3389/fendo.2022.920200

Yuan, Z. F., Mao, S. S., Shen, J., Jiang, L. H., Xu, L., Xu, J. L., & Gao, F. (2020). Insulin-Like Growth Factor-1 Down-Regulates the Phosphorylation of FXYD1 and Rescues Behavioral Deficits in a Mouse Model of Rett Syndrome. *Frontiers in Neuroscience*, *14*. https://doi.org/10.3389/fnins.2020.00020

Yuliyanto, P. E., Ratnawiningsih, H., Faridah, I. N., Perwitasari, D. A., Irham, L. M., Rahman Afief, A., Djaka Purwanto, B., & Adikusuma, W. (2023). Perkembangan Studi Dengue Kaitannya Dengan Interleukin (Il-6): Bibliometrik Analisis Dari Tahun 1992-2022 Trend of Dengue Study Related To Interleukin (Il-6): Bibliometric Analysis From 1992-2022. In *Medical Sains: Jurnal Ilmiah Kefarmasian* (Vol. 8, Issue 1).

Zhu, J., Wang, Z., Wang, W., Fan, J., Zhang, Y., Li, X., Liu, J., Jiang, S., Deng, K., Duan, L., Yao, Y., & Zhu,

H. (2021). Xanthomatous Hypophysitis: A Case Report and Comprehensive Literature Review. In *Frontiers in Endocrinology* (Vol. 12). Frontiers Media S.A. https://doi.org/10.3389/fendo.2021.735655