

The Association of Low Birth Weight and the Incidence of Stunting among Under-Fives in Indonesia: A Systematic Review

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Abstract

Background: Stunting or failure to thrive in children is characterized by lower height compared to the child's age standard. Stunting in children under five not only affects their physical and cognitive development, but also impacts their future quality of life. LBW is one of the factors that increase the risk of stunting. This study aimed to examine the association between low birth weight (LBW) and the prevalence of stunting in children under five through a systematic review.

Method: The search for scientific articles of case-control analytic observational studies with research locations in Indonesia from 2020 to 2024 was conducted through two databases, namely Semantic Scholar and Google Scholar using Harzing's Publish or Perish application. This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines with study quality assessment using The JBI Critical Appraisal Checklist for Case-Control Study.

Result: From a total of 63 articles obtained, 13 articles were extracted after going through a screening process based on inclusion criteria, exclusion criteria and article quality assessment. Of the 13 studies, 10 studies or 77%, concluded that LBW had an association with stunting.

Conclusion: Based on a systematic review, LBW is one of the important risk factors contributing to stunting among children under five in Indonesia. Therefore, interventions that focus on improving maternal nutrition and education on maternal health before, during, and after pregnancy are very important to be maximized to reduce and minimize the incidence of LBW and prevent stunting.

Keywords: Low birth weight, Stunting, Systematic review, Toddlers

INTRODUCTION

Stunting is a serious health problem affecting children around the world, especially in developing countries like Indonesia. Based on data from the World Health Organization (WHO), by 2022, around 148.1 million children under the age of 5 will be stunted, with a prevalence rate of 22.3%. Meanwhile, the Indonesia Health Survey¹ results in 2023 showed a decrease in the prevalence of stunting from 21.6%² to 21.5%. This decline has occurred continuously over the past 10 years (2013—2023). However, this figure still needs to reach the target set in the Medium-Term National Development Plan (2020-2024), which is 14% in 2024, and has yet to meet the WHO standard, which should be below 20%.

Stunting, which refers to the condition of growth retardation in children, is seen in low height compared to the child's age standard. This condition affects the child's physical growth and cognitive development.³ Stunting also has a significant economic impact, as stunted children tend to have lower productivity levels in adulthood, which can lead to reduced income and exacerbate poverty. In addition, the healthcare costs of addressing the health problems caused by stunting place a heavy burden on the national health system.⁴

Stunting can be identified by measuring a toddler's weight and length or height and then comparing it with existing standards. The child is categorized as short or stunted if the measurement results are lower than usual (Z-Score) between <-2 SD to -3 SD. Physically, stunted toddlers will look

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shorter than their peers.⁵ The occurrence of stunting in toddlers is caused by many factors, including poverty⁶, lack of application of exclusive breastfeeding⁷, nutritional intake⁸, mother's education⁹, infectious disease experienced by the child¹⁰, environmental sanitation factors¹¹ and other factors. Of these factors, one factor that directly contributes to stunting is the condition of low birth weight (LBW), which refers to the condition of the baby's weight at birth below 2500 grams, regardless of gestational age or gestation period.⁴

Birth weight has a major influence on height growth in children, especially at 0—6 months of age. LBW infants tend to be more susceptible to nutritional deficiencies due to limited body fat reserves. Fat reserves are essential for growth and physical development in the early months of life. Lack of nutritional intake during this period can impact the development of height (stunting) and weight in the long term.¹²

The systematic review approach is important because it allows the synthesis of data from multiple studies to obtain more accurate and generalizable conclusions. With a standardized methodology, this review reduces selection bias, increases external validity, and identifies patterns of association between LBW and stunting. In addition, the results of the systematic review can provide a strong scientific basis for public health policies to prevent stunting more effectively.

Several studies have identified factors that influence stunting, including studies on the relationship between LBW and stunting, but there are still gaps in terms of consistency of findings, methodological variability, and mediating and moderating factors that influence the relationship. Some studies report a significant association between LBW and stunting, while others show inconsistent results. In addition, differences in population characteristics, environment and analytical approaches used may affect the conclusions reached. The purpose of this study was to conduct a systematic review of the existing literature, with a focus on reviewing and integrating findings on the association between LBW and stunting in children under five. Through in-depth analysis of related studies, it is expected that conclusions can be obtained regarding the consistency of findings related to the relationship between LBW and stunting. The results of this study are expected to provide a strong scientific basis to support more effective public health interventions to prevent stunting in Indonesia.

METHOD

Participants and Study Design

This study used the systematic review method, which was conducted to examine the association of LBW with stunting in toddlers. This method involves systematically collecting, screening, and analyzing relevant studies.

Measurements and Procedure

The systematic review used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. Harzing's Publish or Perish is a tool used to search for scientific articles from two databases, namely Semantic Scholar and Google Scholar. The search process used the keywords 'low birth weight' AND 'stunting' AND 'Indonesia' AND 'case-control study'. The entire process of searching, selecting, and excluding articles was documented in a PRISMA flowchart using Canva: Design, Art, and Editor to illustrate the stages from search to selection of articles used in the analysis, as shown in [Figure 1].

PICOS (Population, Intervention, Comparison, Outcome and Study Design)

- a. Population: under-fives in Indonesia
- b. Intervention: None, only observation of children born with LBW.
- c. Comparison: toddlers born with LBW and normal weight.
- d. Outcome: Incidence of stunting in children under five
- e. Study Design: A case-control study

Operational Definition

Two indicators were used in this systematic review: low birth weight and stunting. Low birth weight defined as birth weight <2500 grams. Stunting was assessed by height lower than the child's age standard (TB/U) with a Z score <-2 SD from the WHO standard.

Inclusion and Exclusion Criteria

The research included in the systematic review must met the following inclusion criteria: (1) the research topic focuses on the relationship between LBW and stunting; (2) using a case-control research design; (3) published within 2020-2024; (4) research conducted in the territory of Indonesia; (5) and articles available in Indonesian or English.

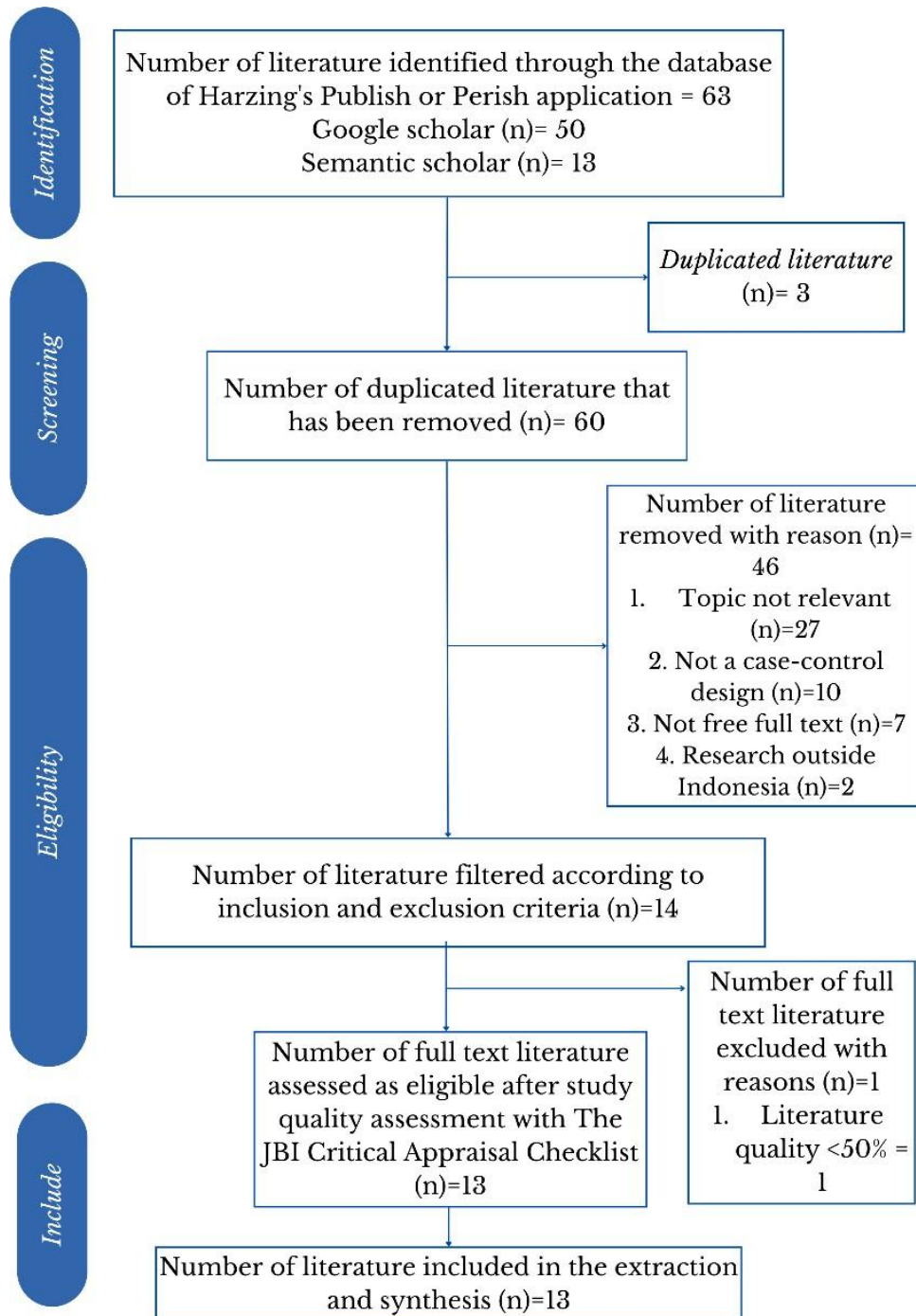


Figure 1. Prisma Flow Chart

Data Extraction

All articles obtained from the two databases were exported to the Mendeley application. The articles were then screened by the first author (BS) and second author (LT) by reading the titles and abstracts and removing duplicated articles. In the next stage, all authors read the full text of the articles that met the inclusion and exclusion criteria. After that, a quality assessment of the study was conducted to ensure the eligibility of the articles to be analyzed.

Quality Assessment

The JBI Critical Appraisal Checklist for Case-Control Studies was used as a guide to assess the quality of the reviewed studies. There were 10 question items with four answer options: yes, no, unclear, and not applicable. Each question answered with yes would get 1 point. The final score is calculated using the formula: the number of scores obtained was divided by the number of questions and multiplied by 100%. If the final score was (>50%), then the article was categorized as suitable and eligible to be included for extraction and synthesis, while articles with a score (<50%) will be excluded. The articles that have passed will be presented in the form of a table using Microsoft Office applications as in (Table 1).

RESULT

Table 1 shows that 13 scientific articles were extracted. Based on the data extraction results of 13 scientific articles, most studies (77%) concluded that there is a link between low-birth weight infants and the incidence of stunting. This relationship was supported by the findings in 10 articles, namely article numbers 1, 3, 4, 5, 6, 7, 9, 10, 11, and 13.

Table 1. Data Extraction Result

Author	Research Location	Population & Sample	P-Value	OR (CI95%)	Outcome & Result
13	Sigi Regency, Central Sulawesi	Study population: 156 children aged between 24 and 59 months. Study sample: 134 children under five in a 1:1 ratio, 67 in the case group and 67 in the control group.	0.000	5.98 (2.476-14.439)	Outcome: Stunting There is an association between LBW and the incidence of stunting in children aged 24-59 months. Logistic regression analysis showed that LBW history is one of the dominating factors in stunting at Kamaipura Health Center in Sibalaya Village, Tambulava Subdistrict, Sigi Regency.
14	Bantul Regency, Special Region of Yogyakarta	Study population: children aged 6- 23 months. Study sample: The randomization results obtained 158 children included, with a ratio of 1:1, 79 for the case group and 79 for the control group.	0.505	0.67 (0.20-2.20)	Outcome: Stunting There is no correlation between LBW and stunting in early childhood in Bantul Regency.
15	Kabupaten Sidenreng Rappang, Sulawesi Selatan	Study population: All stunted toddlers in the 2019 Central Bureau of Statistics report. Study sample: 102 respondents, 51 for cases and 51 for controls.	0.000	10.44 (3.28-33.30)	Outcome: Stunting Low birth weight (LBW) is the dominant factor contributing most significantly to stunting among the under-fives in Sidenreng Rappang District.

16	Jeneponto Regency, South Sulawesi	Population: All under-fives aged 6 to 24 months in Bontomatene Village, Jeneponto District. Sample: 45 respondents, 15 cases, and 30 controls.	0.006	13.750 (1.454-129.987)	Outcome: Stunting There is an association between LBW and the incidence of stunting in toddlers aged 6-24 months in Jeneponto District. The distribution table shows that the highest percentage of children under five with birth weight <2500grams
17	Maros Regency, South Sulawesi	Population: Children aged 6-23 months recorded in the Tanralili Health Center, Maros District report. Sample: 260 respondents, 130 cases, and 130 controls.	0.011	2.538 (1.243-5.182)	Outcome: Stunting There is an association between LBW and the incidence of stunting in children aged 6-23 months in Maros District.
18	South Lampung Regency	Population: Mothers with children aged 24 to 59 months around the working area of Way Urang Health Center (Tajimalela, Taman Agung and Merak Belantung villages). Sample: 118 respondents, 33 cases, and 85 controls.	0.024	2.595 (1.119-6.018)	Outcome: Stunting There is an association between LBW and the incidence of stunting in children aged 24-59 months in the working area of Puskesmas Way Urang South Lampung.
19	Liwa City, West Lampung Regency	Population: All children aged 12 to 59 months living in seven selected horticultural farming villages in Liwa City. Sample: 160 respondents, 40 cases, and 120 controls	<0.01	4.35 (1.38-13.78)	Outcome: Stunting There is an association between LBW and the incidence of stunting among children under 6-59 months old in the horticultural farming area of Liwa City, West Lampung Regency.
20	Kebumen, Central Java	Population: Mothers with children aged 6-24 months in the working area of Puskesmas Puring Kebumen, Central Java. Sample: 86 samples were obtained in a 1:1 ratio, 43 in the case group and 43 in the control group.	0.122	3.47 (0.88-13.76)	Outcome: stunting There was no significant association between LBW and the incidence of stunting in the rural area of Puring Health Center. However, other factors such as gender, maternal height, and parenting patterns at 6-8 months of age were found to have a significant association with the incidence of stunting in the area.
21	Surabaya	Population: Children aged 2- 5 years whose height and birth weight data were recorded in medical records	0.001	19.3 (-)	Outcome: stunting There is a significant correlation between the history of low birth weight and the incidence of stunting in children aged 2-5 years in the working area of Puskesmas Banyu

		at Banyu Urip Health Center Surabaya. Sample: 60 samples were obtained in a 1:1 ratio of 30 cases and 30 control groups.			Urip Surabaya.
22	Riau	Population: Toddlers in 5 posyandu in the village of Kemenangan Tani Riau. Sample: A total of 78 samples with a ratio of 1:1, namely 38 case groups and 38 control groups.	0.00	7.333 (2.480-21.680)	Outcome: stunting LBW history is significantly associated with stunting in children aged 1-5 years in Kemenangan Tani Village.
23	Kendari City	Population: Mothers and young children (0-59 months) in seven subdistricts in Kendari City. Sample: 180 mother-child samples divided into two, 90 samples for cases and 90 control samples.	0.000	5.688 (0.068-0.453)	Outcome: stunting There is an association between LBW and the occurrence of stunting in toddlers in Kendari City. LBW is the main factor associated with stunting. A child's risk of being stunted is six times higher if the family history has LBW. Meanwhile, the gender of the child has no relationship with the incidence of stunting.
24	Tangerang Regency	Population: Mothers with toddlers at Caringin Community Health Center in Tangerang District. Sample: 150 mother-child samples with a 1:1 ratio	0.246	-	Outcome: stunting There is no correlation between LBW and stunting in children.
25	Kotamobagu City	Population: 7163 children aged (6-24 months). Sample: 88 samples of children divided into two with a ratio of 1: 1.	0.000	40.600 (8.622-191.178)	Outcome: stunting This study proves that there is a very close correlation between LBW and stunting in infants. LBW babies are 40.6 times more likely to be stunted than normal birth-weight babies.

DISCUSSION

Based on data from UNICEF and WHO, Indonesia ranks 27th out of 154 countries in terms of stunting prevalence globally. At the regional level, Indonesia ranks fifth among Asian countries. The occurrence of stunting in toddlers is an accumulation of many factors. One of the risk factors is the condition of toddlers who are born with low weight or LBW.²⁶ Various studies explain that LBW conditions can be a risk factor for stunting because LBW conditions will cause children's growth to be disrupted. If this condition continues without adequate nutrition, the baby becomes more vulnerable to infection and disease. If LBW babies do not receive optimal care, this condition can lead to stunting.²⁷

Infants born weighing less than 2500 grams, known as LBW, can generally experience difficulties in following normal development according to their age.²⁸ A study states that babies born with low body weight have health risks that can continue into adulthood. This situation can

hamper mental and physical development and cause low immunity in the child's body, making it more susceptible to infection.²⁹ A baby's weight at birth is an important factor affecting the child's future growth. Children who have a history of LBW are at risk of growth disorders during childhood. The mother's condition during pregnancy and labor can affect the health of her child. LBW babies often indicate health problems in the mother during pregnancy.³⁰

Previous research²⁴ showed no correlation between LBW and the incidence of stunting. However, other factors, such as maternal nutritional status during pregnancy (Odds Ratio (OR) 7.667), HB levels (OR 2.563), and exclusive breastfeeding history (OR 2.545), were associated with stunting. Previous study²⁰ also showed no association between low birth weight and the incidence of stunting in rural areas of the Puring Health Center. The study stated that several factors that were significantly associated with the incidence of stunting were child gender (Adjusted OR 3.59), maternal body length (AOR 3.75), and childcare at 6-8 months of age (Adjusted OR 0.026). A research¹⁴ in Bantul Regency also revealed no association between low birth weight and stunting. Stunting status in the study was associated with a need for more dietary variety, vitamin D intake from complementary foods, and birth length.

Regarding its strength, this study can contribute to a clearer understanding of the causal relationship between LBW and stunting, which is useful as a basis for efforts to prevent and overcome stunting in infants born with LBW conditions. However, this systematic review still has limitations on the specified period, so the results may not be generalized to a broader period. It is hoped that future research will accumulate a longer period and integrate data in quantitative and qualitative research, providing in-depth insight into stunting in LBW infants.

CONCLUSION

Based on the systematic review conducted, there is an association between low birth weight and the incidence of stunting in toddlers. This suggests that LBW is an important risk factor for stunting in toddlers. This review supports the opinion that toddlers born with a body weight below 2500 grams or LBW will have a greater chance of experiencing stunting compared to toddlers born with normal weight. Nutrition optimization interventions for pregnant women need to be maximized, and maternal health education before pregnancy, during pregnancy, and after pregnancy also needs to be strengthened to minimize LBW in children born as an effort to prevent stunting.

REFERENCES

1. Hutagalung VE. Kecelakaan Kerja yang Dialami Pekerja yang Sedang Dalam Keadaan Work From Home. *Jurist-Diction*. 2021;4(2):775. <https://doi.org/10.20473/jd.v4i2.25789>.
2. International Labor Organization. Meningkatkan Keselamatan dan Kesehatan Pekerja Muda. Kantor Perburuhan Internasional, CH- 1211 Geneva 22, Switzerland. 2022.
3. ICOH C. Sharing Solutions In Occupational Health Through And Beyond The Pandemic. 2022;1–48. 4. Ghasemi Noughabi, M., Sadeghi, A., Mohammadzadeh Moghaddam, A., & Jalili Qazizadeh, M. (2020). *Fatigue Risk Management: Assessing and Ranking the Factors Affecting the Degree of Fatigue and Sleepiness of Heavy-Vehicle Drivers Using TOPSIS and Statistical Analyses*. *Iranian Journal of Science and Technology - Transactions of Civil Engineering*, 44(4), 1345–1357.
5. Yamauchi, T., Sasaki, T., Takahashi, K., Umezaki, S., Takahashi, M., Yoshikawa, T., Suka, M., & Yanagisawa, H. (2019). *Long working hours, sleep-related problems, and near-misses/injuries in industrial settings using a nationally representative sample of workers in Japan*. *PLoS ONE*, 14(7). <https://doi.org/10.1371/journal.pone.0219657>.
6. Grech, M. R. (2016). *Fatigue risk management: A maritime framework*. *International Journal of Environmental Research and Public Health*, 13(2). <https://doi.org/10.3390/ijerph13020175>.
7. Innah M, Alwi MK, Gobel FA, Habo H. Faktor yang Berhubungan dengan Kelelahan Kerja pada Penjahit Pasar Sentral Bulukumba. *Wind Public Heal J*. 2021;2(1):59–69. <https://doi.org/10.33096/woph.v2i1.123>.
8. WorkSafe New Zealand. Risk factors, prevalence, and interventions to address workplace fatigue. *Res Eval*. 2021;(September).
9. Hijah NF, Setyaningsih Y, Jayanti S. Iklim Kerja, Postur Kerja, dan Masa Kerja Terhadap Kelelahan Kerja pada Pekerja Bengkel Las. *J Penelit dan Pengemb Kesehat Masy Indones*.

- 2021;2(1):11–6. <https://doi.org/10.15294/jppkmi.v2i1.47282>.
10. Sunaryo M, Nourma M. Gambaran Dan Pengendalian Iklim Kerja Dan Keluhan. *MTPH J.* 2020;4(2):171–80. <https://doi.org/10.33086/mtpjh.v4i2.1635>.
11. Syuqinah B, Indah MF, Ishak NI. Determinants of Work Fatigue Among Technical Service Workers at PT. PLN in Tabalong Regency. *J UNISKA* [Internet]. 2020;6(2):114–24. Available from: [http://eprints.uniska-bjm.ac.id/2613/3/Artikel Bitu Syuqinah 16070232.pdf](http://eprints.uniska-bjm.ac.id/2613/3/Artikel%20Bitu%20Syuqinah%2016070232.pdf)
12. Layuk S, Pesak E, Danial M. Relationship between Age, Working Period and Work Duration with Fatigue on Pedycab Drivers in North Kotamobagu District, North Sulawesi Indonesia. *Int J Pharma Med Biol Sci.* 2019;8(3):91–5. doi: 10.18178/ijpmbs.8.3.91-95.
13. Agustin N, Sariah. Hubungan Faktor Individu dengan Kelelahan Kerja pada Karyawan Di PT. Adhi Persada Gedung Bekasi Tahun 2018. *J Persada Husada Indones* [Internet]. 2018;5(19):18–30. Available from: <http://jurnal.stikesphi.ac.id/index.php/kesehatan>. <https://doi.org/10.56014/jphi.v5i19.159>.
14. Rudyarti E. Analisis hubungan stres kerja, umur, masa kerja dan iklim kerja dengan perasaan kelelahan kerja pada perawat. *Semin Nas Kesehat Masy 2020* [Internet]. 2020;240–9.
15. Maulani HA, Sukismanto, Yuningrum H, Nugroho A. Shift Kerja dan Masa Kerja Terhadap Kelelahan Kerja pada Pengemudi Angkutan Batu Bara. *J Penelit dan Pengemb Kesehat Masy Indones.* 2020;1(1):48–53. <https://doi.org/10.15294/jppkmi.v1i1.41423>.
16. Nursafitrianadevi L. YM. SA. & MM. Hubungan Postur Kerja dan Status Gizi dengan Kelelahan Kerja di UMKM Keripik Tempe Sanan. *Sport Sci Heal.* 2024;6(1):88–100. doi: 10.17977/um062v6i12024p88-100
17. Cendana F, Masribut M, Candra L. Analisis Risiko Kelelahan Kerja Ditinjau Dengan Menggunakan Metode Rula Pada Pekerja Laundry Di Rumah Sakit Umum Daerah Kecamatan Mandau Tahun 2020. *Media Kesmas (Public Heal Media).* 2021;1(3):742–50. <https://doi.org/10.25311/kesmas.Vol1.Iss3.124>.
18. Latief AWL, Bahar SN, Maharja R, Rostati R, Irsyad M. Faktor yang Berhubungan dengan Kelelahan Kerja pada Petani. *J Ilm Kesehat.* 2022;4(1):146–54. DOI: 10.36590/jika.v4i1.240.
19. Yanti P, Allo AA. Hubungan antara Sikap Kerja dengan Kelelahan Kerja pada Tukang Jahit di Kecamatan Mentiroitu, Toraja Utara. *J Din Kesehat Masy Hub.* 2022;1(1):16–21.
20. Boekoesoe L, Prasetya E, Gyardani Samani G, Fikar Ahmad Z, Surya Indah Nurdin S. Faktor Risiko Yang Berhubungan Dengan Kelelahan Kerja Dengan Metode Fatigue Assessment Scale (Fas) Pada Pekerja Konstruksi. *Jambura J Epidemiol* [Internet]. 2021;3(1):18–26. DOI: 10.56796/jje.v2i1.21842.
21. Aminah RAS, Porusia M. Hubungan masa kerja, jenis kelamin dan iklim kerja dengan kelelahan kerja di PT Batik X. *Holistik J Kesehat.* 2024;18(5):652–9. <https://doi.org/10.33024/hjk.v18i5.284>.
22. Restuadi H, Suryati T, Dinaryati RS, Djupri DR. Hubungan Status Gizi Dan Iklim Kerja Dengan Tingkat Kelelahan Kerja. *J Lang Heal* [Internet]. 2024;5(1):31–8. Available from: <http://jurnal.globalhealthsciencegroup.com/index.php/JLH>. <https://doi.org/10.37287/jlh.v5i1.2773>.
23. Pratama FD, Harianto F, Aulady MFN. Hubungan Kelelahan Kerja dengan Kecelakaan Kerja pada Proyek Pembangunan Gedung di Surabaya. *J Tek Sipil ITP.* 2024;11:70–6. <https://doi.org/10.21063/jts.2024.V11i01.070-76>.
24. Aulia, Aladin, Tjendera M. Hubungan Kelelahan Kerja dengan Kejadian Kecelakaan Kerja pada Pekerja Galangan Kapal. *J Kesmas Gizi.* 2018;1(1):168–168. <https://doi.org/10.35451/jkg.v1i1.106>.
25. Charisma R, Mandagi P, Sondakh RC, Maddusa S, Kesehatan F, Universitas M, et al. Hubungan Kelelahan Kerja dengan Kejadian Kecelakaan Kerja di PT. Putra Karangatang Desa Popontolen Kabupaten Minahasa Selatan. *J KESMAS.* 2022;11(4):28–34.