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Predictive Effects of Immunization and Low Birth Weight on Stunting in Rural Indonesia: A Case Study from Selayar

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ABSTRACT

Introduction: Stunting continues to be a significant public health challenge in Indonesia, especially in rural regions where access to integrated child health services is limited. This study presents a novel dual variable analysis focusing on two interrelated risk factors immunization status and low birth weight (LBW) which have rarely been examined simultaneously in a rural Indonesian setting. It aims to explore the association between immunization coverage and low birth weight (LBW) and their influence on stunting prevalence among children aged 37 to 72 months in the jurisdiction of the Polebunging Health Center, Selayar Regency.

Methods: Employing a cross sectional design, data were collected from 51 children using anthropometric measurements, immunization records, and birth history documentation. The study used WHO growth standards interpreted through Indonesia's operational framework (the Maternal and Child Health Book, or KIA Book)

Results: Findings revealed that 11.8% of the children had incomplete immunization, while 9.8% had a history of LBW. Statistical analysis demonstrated significant associations between both risk factors and stunting ($p < 0.05$). Children with incomplete immunization were eight times more likely to be stunted, and those with LBW had twelve times higher odds of experiencing growth faltering. These results align with prior literature highlighting the importance of early preventive interventions in child development

Conclusion: This study contributes localized, high resolution evidence on the predictive roles of immunization and LBW in rural child stunting, reinforcing the need for integrated maternal and child health strategies. While the sample size and non-random sampling limit generalizability, the findings offer actionable insights for targeted interventions in similar socio epidemiological contexts. Future longitudinal studies are recommended to validate causal relationships and inform scalable public health policies.

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INTRODUCTION

Stunting is a persistent public health issue globally, with severe implications for child development, especially in low and middle income countries like Indonesia. According to the Indonesian Ministry of Education, the national prevalence of stunting stood at 21.6% in 2023, far from the targeted reduction to 14% by 2024 (1). Stunting is defined as a height for age Z score below 2 standard deviations from the WHO growth standards, indicating chronic malnutrition. In the Indonesian primary healthcare system, these Z scores are operationalized through the Maternal and Child Health Handbook (KIA Book), which is used as the primary reference in monitoring child growth and nutritional status in Posyandu and Puskesmas services. It results from a multifactorial etiology, including inadequate nutrition, recurrent infections, and suboptimal health services, often exacerbated by social determinants such as poverty and limited access to clean water and sanitation (2). Stunted children are at risk of long term cognitive impairments, poor school performance, lower productivity, and increased susceptibility to chronic diseases in adulthood (3,4).

Despite comprehensive efforts by the Indonesian government through multi sectoral programs such as increasing immunization coverage and improving maternal nutrition progress remains uneven. For example, in Selayar Regency, the stunting prevalence rose from 27.4% in 2021 to 32.2% in early 2023, indicating localized spikes even as national efforts intensify (5). In the Polebunging Health Center catchment area alone, stunting cases increased from 44 in 2021 to 63 in 2022, with 60 cases already recorded by February 2024. These concerning trends warrant a deeper analysis of local determinants contributing to child stunting. Formal data from the Ministry of Health and regional health information systems such as e PPGBM further corroborate these increases, underscoring a critical gap in service reach and impact.

Two commonly cited risk factors are immunization status and birth weight. Immunization serves a dual purpose in child health it prevents infectious diseases and indirectly supports nutritional status by reducing morbidity that impairs nutrient absorption and appetite (6,7). Studies have demonstrated that children with incomplete basic immunization are significantly more susceptible to stunting, often due to preventable illnesses that impede growth (8,9). In areas like Polebunging, where access to continuous healthcare services is often limited, immunization gaps can critically exacerbate stunting risks.

Low birth weight (LBW), defined as less than 2,500 grams at birth, is another critical factor strongly associated with stunting. LBW is often a result of poor maternal nutrition, inadequate prenatal care, and socio economic stressors during pregnancy. These children are biologically predisposed to growth faltering and developmental delays, which can persist despite postnatal interventions (10,11). In the context of Selayar Regency, 9.8% of the study respondents had LBW, and all were categorized as stunted based on WHO growth standards.

Previous research, including a study by Ramli et al. (2023), acknowledged the influence of both immunization status and LBW on stunting (12). However, most prior studies have explored these variables in isolation, focusing on either immunization or birth weight separately. Few studies have conducted simultaneous analysis of these risk factors in isolated rural populations, limiting the generalizability of their findings to localized interventions. This study addresses that gap by analyzing both factors concurrently, thus offering a more comprehensive understanding of stunting determinants.

This gap in the literature is further exacerbated by the variability in healthcare seeking behaviors, influenced by local culture and health literacy. Research by Alaba et al. (2021) and Ataullahjan et al. (2023) emphasizes the need to understand how integrated healthcare and immunization strategies function in under resourced areas (13,14). The lack of region specific data hinders the creation of tailored interventions aimed at high burden communities like those served by Polebunging Health Center.

Given these challenges, this study aims to examine the relationship between immunization status and low birth weight history with the incidence of stunting in the Polebunging Health Center area. By focusing on a rural Indonesian setting, this research contributes to the existing body of knowledge with localized insights and empirical data. The novelty of this study lies in its hypothesis driven, dual variable approach within a defined rural geography an approach that remains underrepresented in the literature despite its critical policy implications. The findings are expected to provide a scientific basis for improving targeted health interventions and supporting policy initiatives to reduce stunting in underserved areas.

METHOD

This study employs a rigorously delineated methodological framework to ensure empirical transparency and analytical coherence. The methodological components are outlined as follows.

Research Type

A quantitative approach with a cross sectional design was utilized to examine the association between immunization status and low birth weight in relation to stunting among children under five. The cross sectional design was selected for its effectiveness in evaluating multiple variables simultaneously at a single point in time, making it highly suitable for investigating correlations in public health studies (15,16). While cross sectional studies limit causal inference, their value lies in generating localized insights and guiding intervention prioritization.

Population and Sample

The study population comprised all stunted children recorded in the Polebunging Health Center's service area, totaling 60 individuals. From this population, a sample of 51 children under five was selected using accidental sampling, a non-probability sampling technique appropriate for exploratory community health studies in settings with limited access to systematic records (13). Inclusion criteria were children aged under five years diagnosed with stunting based on height for age (Z score < 2 SD) and whose health data could be obtained from the Maternal and Child Health (KIA) book.

However, it is acknowledged that accidental sampling introduces potential selection bias and limits external validity, as the sample may not adequately represent the wider population. These constraints are inherent to field based studies in remote or data sparse contexts but are mitigated here through rigorous inclusion criteria and consistency in clinical classification.

Research Location

The study was conducted in the service area of Polebunging Health Center, located in Selayar Regency, South Sulawesi, Indonesia. Data collection occurred during March and April 2024.

Data Collection Instruments Procedures

Data were collected through a combination of anthropometric measurements, immunization records, and observational checklists. Children's height was measured using a SECA 417 portable stadiometer, calibrated weekly following WHO guidelines to ensure reliability and accuracy**.** Stunting status was determined using WHO child growth standards interpreted through the Buku KIA. Immunization status was assessed based on recorded information in the KIA book, categorizing children into either complete or incomplete immunization groups according to national immunization guidelines. Observational checklists were used to verify data accuracy and completeness.

Data Analysis

The data were analyzed using both univariate and bivariate statistical methods. Univariate analysis served to present the distribution of respondent characteristics in terms of frequency and percentage. To explore the relationship between categorical variables specifically immunization status and birth weight with stunting, bivariate analysis was conducted using the Chi square test. Prior to applying the Chi square test, assumptions regarding minimum expected cell frequency were examined. Where cell counts were below the required threshold (expected count < 5), Fisher's Exact Test was used to maintain analytical robustness. A significance level of $p < 0.05$ was applied. Furthermore, odds ratios (OR) were calculated to determine the magnitude and direction of the associations. The Chi square test is particularly useful for testing the independence between categorical variables, while the odds ratio offers a clear interpretation of effect size, especially in epidemiological research. (17,18).

RESULTS

Sociodemographic Characteristics of Parents

The analysis of respondent demographics indicated that the majority of parents were between the ages of 22 and 35, representing 64.7% (n = 33) of the sample. The remaining 35.3% (n = 18) were aged between 36 and 45. Regarding educational background, 58.8% (n = 30) of parents had completed primary to junior high school, 31.4% (n = 16) had completed high school, and only 9.8% (n = 5) had attained a college level education. Most parents (88.2%, n = 45) identified as housewives (IRT), while 5.9% (n = 3) were private sector employees, and another 5.9% (n = 3) worked under temporary contracts.

These findings highlight a concentration of low educational attainment and occupational informality among parents, which may reinforce vulnerability to nutritional and health disparities in early childhood. Such conditions align with established social determinants of child stunting, particularly through constrained access to health information and services (19,20). The predominance of low income occupations and limited educational attainment in the sample may explain the prevalence of nutritional deficiencies observed.

Table 1. Frequency Distribution of Respondents' Parental Characteristics

Parental Age	**Frequency**	**Percentage (%)**
22–35 years	33	64.7
36–45 years	18	35.3
Total	**51**	**100.0**
Education Level	**Frequency**	**Percentage (%)**
Elementary–Junior High School	30	58.8
Senior High School	16	31.4
Bachelor's Degree	5	9.8
Total	**51**	**100.0**
Occupation	**Frequency**	**Percentage (%)**
Housewife (Unemployed)	45	88.2
Private Sector Employee	3	5.9
Contractual/Temporary Staff	3	5.9
Total	**51**	**100.0**

Source: Primary Data 2025

Characteristics of Stunted Children

With respect to the children's characteristics, most respondents fell into the older age range of 37–72 months (58.8%, n = 30), followed by 25–36 months (23.5%, n = 12), and 1–24 months (17.6%, n = 9). Parity analysis revealed that 74.5% (n = 38) of children were from families with 2–4 births, while 15.7% (n = 8) and 9.8% (n = 5) came from single parity and high parity households (>4 births), respectively.

Birth weight statistics indicated that 90.2% (n = 46) of the children had a normal birth weight (2500–4000 grams), while 9.8% (n = 5) were born with low birth weight (LBW, <2500 grams). Regarding birth length, 76.5% (n = 39) had a length between 48 and 52 cm, whereas 23.5% (n = 12) were shorter than 48 cm. Most of the stunted children (96.1%, n = 49) fell under the moderately stunted category (3 SD to 2 SD), with only 3.9% (n = 2) classified as severely stunted (< 3 SD).

These patterns reinforce the biological vulnerability introduced by early life health conditions. Particularly, LBW and short birth length appear as key markers of later growth faltering, as confirmed by previous studies (21,22).

Table 2. Distribution of Respondents Based on Parental Characteristics

Child's Age		
Age Group	**Frequency**	**Percentage (%)**
Infant (1–24 months)	9	17.6
Toddler (25–36 months)	12	23.5
Preschooler (37–72 months)	30	58.8
Total	**51**	**100.0**
Parity		

Number of Children	Frequency	Percentage (%)
1	8	15.7
2–4	38	74.5
>4	5	9.8
Total	**51**	**100.0**
Birth Weight		
Category	**Frequency**	**Percentage (%)**
Normal (2500–4000 grams)	46	90.2
Low Birth Weight (<2500 g)	5	9.8
Total	**51**	**100.0**
Birth Length		
Length Category	**Frequency**	**Percentage (%)**
48–52 cm	39	76.5
<48 cm	12	23.5
Total	**51**	**100.0**
Height for Age (Z score)		
Nutritional Status	**Frequency**	**Percentage (%)**
Severely stunted (< –3 SD)	2	3.9
Stunted (–3 to –2 SD)	49	96.1
Total	**51**	**100.0**

Source: Primary Data, 2024

Immunization Coverage

Analysis of immunization data revealed that all respondents had received the BCG vaccine. Coverage for other basic immunizations was also high but not universal. Polio vaccination was complete in 98% (n = 50) of cases, while DPT was complete in 90.2% (n = 46), and measles and hepatitis B immunizations were completed in 96.1% (n = 49) and 98% (n = 50), respectively. HiB immunization was similarly high, at 98% (n = 50).

Despite these high individual coverage rates, only 88.2% (n = 45) of children had received all the required basic immunizations according to the national schedule. The remaining 11.8% (n = 6) had incomplete immunization records due to omissions in one or more vaccines.

This finding indicates a critical gap in the continuity of immunization programs in rural contexts. Even single dose omissions can disrupt protective immunity and increase vulnerability to infection related growth delays (23,24).

Table 3. Distribution of Respondents' Characteristics Based on Immunization Status

BCG Immunization		
Category	**Frequency**	**Percentage (%)**
Not Given	0	0.0
Complete	51	100.0
Incomplete	0	0.0
Total	**51**	**100.0**
Polio Immunization		
Category	**Frequency**	**Percentage (%)**
Not Given	0	0.0
Complete	50	98.0
Incomplete	1	2.0
Total	**51**	**100.0**
DPT Immunization		
Category	**Frequency**	**Percentage (%)**
Not Given	0	0.0
Complete	46	90.2
Incomplete	5	9.8
Total	**51**	**100.0**

Measles Immunization		
Category	**Frequency**	**Percentage (%)**
Not Given	1	2.0
Complete	49	96.1
Incomplete	1	2.0
Total	**51**	**100.0**
Hepatitis B Immunization		
Category	**Frequency**	**Percentage (%)**
Not Given	1	2.0
Complete	50	98.0
Incomplete	0	0.0
Total	**51**	**100.0**
HiB Immunization		
Category	**Frequency**	**Percentage (%)**
Not Given	1	2.0
Complete	50	98.0
Incomplete	0	0.0
Total	**51**	**100.0**
Basic Immunization Coverage		
Category	**Frequency**	**Percentage (%)**
Not Given	0	0.0
Complete	45	88.2
Incomplete	6	11.8
Total	**51**	**100.0**

Source: Primary Data, 2024

Immunization and Stunting Relationship

Cross tabulation of immunization status and stunting outcomes indicated that 88.3% (n = 45) of respondents had complete immunization, with 84.3% (n = 43) moderately stunted and 3.9% (n = 2) severely stunted. Conversely, all six children with incomplete immunization (11.7%) were found to be moderately stunted.

Chi square analysis revealed a statistically significant association between immunization status and stunting (p = 0.044). The odds ratio (OR) indicated that children with complete immunization were eight times more likely to experience improved growth outcomes compared to their incompletely immunized peers (OR = 8.000).

These findings reinforce the protective role of immunization against growth related pathologies and highlight the need for continuous immunization outreach to close existing gaps (25,26).

Table 4. Association Between Birth Weight and Stunting Incidence in the Working Area of Polebunging Public Health Center

Immunization Status	Stunting – Severely Stunted (< –3 SD)		Stunting – Stunted (–3 to –2 SD)		Total		P Value	Odds Ratio
	f	%	f	%	f	%		
Complete	2	3.9	43	84.3	45	88.3	0.044	8.000
Incomplete	0	0.0	6	11.7	6	11.7		
Total	**2**	**3.9**	**48**	**94.1**	**51**	**100.0**		

Source: primary Data 2024

Low Birth Weight and Stunting Relationship

Analysis of birth weight in relation to stunting showed that 90.2% (n = 46) of children had normal birth weight, among whom 86.3% (n = 44) were moderately stunted and 3.9% (n = 2) were severely stunted. Meanwhile, all five children with LBW (9.8%) were classified as moderately stunted.

Statistical testing confirmed a significant association between LBW and stunting (p = 0.034), with an odds ratio of 12.000. This suggests that children born with LBW were twelve times more likely to be stunted compared to those born with normal weight.

This outcome is in line with earlier findings emphasizing the importance of maternal nutrition and prenatal care in mitigating risks associated with LBW and its long term impact on child development (3,10).

Table 5. Association Between Birth Weight and Stunting Incidence in the Working Area of Polebunging Public Health Center

Birth Weight	Stunting Severely Stunted (< –3 SD)		Stunting – Stunted (–3 to –2 SD)		Total		P Value	Odds Ratio
	f	%	f	%	f	%		
Normal (2500–4000 grams)	2	3.9	44	86.3	46	90.2	0.034	12.000
LBW (<2500 grams)	0	0.0	5	9.8	5	9.8		
Total	**2**	**3.9**	**49**	**96.1**	**51**	**100.0**		

Source: primary Data 2024

DISCUSSION

Interpretation of Key Findings

The present study aimed to examine the relationship between immunization status and low birth weight (LBW) history with the incidence of stunting in children aged 37 to 72 months in the operational area of Puskesmas Polebunging. The findings offer substantial insights into two critical risk factors for stunting and their interconnected pathways influencing child growth outcomes.

The analysis confirms a significant association between incomplete immunization status and higher rates of stunting, corroborated by the chi square test ($p = 0.044$) and odds ratio analysis, which found that children with incomplete immunization were eight times more likely to experience stunting. This finding aligns with literature suggesting that full immunization confers indirect protection by reducing infection related nutritional loss and inflammation (26,27). National coverage reports from Indonesia indicate that immunization completeness remains uneven across provinces, with rural and remote areas showing persistent service gaps (Kemenkes RI, 2023). In this regard, our findings mirror national disparities and highlight the urgent need for continuity and completeness of immunization schedules (28).

Stunting as a multifactorial condition often stems from both direct physiological deficits and indirect socioeconomic constraints. In the context of immunization, the data from this study show that even children receiving the BCG vaccine at birth did not necessarily complete their full immunization schedule, resulting in vulnerability to preventable diseases and subsequent growth impairments. Prior studies reinforce that incomplete immunization status correlates with a significantly increased risk of stunting up to 4.9 times higher in certain settings (8,9). This relationship is often mediated through repeated infections and associated malnutrition, further undermining developmental potential.

Importantly, the association between immunization and growth outcomes has also been validated in multi country meta analyses, including in South Asia and Sub Saharan Africa, where incomplete vaccine uptake is consistently linked to child undernutrition and growth failure (6,25). These cross national findings strengthen the external relevance of our study and suggest the need for immunization policy enforcement that is both equitable and culturally adaptive.

The role of immunization is also socio structural. Educated and economically empowered caregivers are more likely to ensure timely and complete immunization, suggesting that public health campaigns must integrate educational strategies and community based outreach (6,29). Health workers, especially community based personnel, have been instrumental in improving immunization adherence and must remain a cornerstone of local health interventions (30).

Comparison with Previous Studies

In terms of LBW, the study found a significant relationship between birth weight and stunting, with LBW children being twelve times more likely to be stunted ($p = 0.034$). This finding is consistent with previous literature emphasizing the long term impact of LBW on postnatal growth and susceptibility to stunting. LBW compromises

early physical development and may hinder a child's ability to catch up in growth during critical windows, especially in the absence of targeted nutritional support.

LBW is typically a result of maternal malnutrition, inadequate antenatal care, and health complications during pregnancy. Therefore, addressing LBW requires a comprehensive intervention strategy that includes maternal nutrition, prenatal monitoring, and education on reproductive health (12,21). While the biological pathway linking LBW to stunting is well established, the present study reinforces the need for early life interventions within the first 1,000 days of life, a window crucial for preventing irreversible growth deficits.

However, not all studies have reported similar results. For instance, Hartati and Uswatun (2020) found no significant relationship between LBW and stunting in a coastal population (31). These discrepancies may be explained by contextual mediators such as maternal education, access to clean water and sanitation, breastfeeding practices, and health service utilization. For example, populations with strong cultural norms around early exclusive breastfeeding may offset the biological disadvantages of LBW through high postnatal nutrition quality. Such factors highlight the importance of disaggregating data interpretation by local behavioral and infrastructural conditions.

In addition to physiological and immunological mechanisms, stunting is also driven by indirect determinants, including household food insecurity, poor sanitation, and inadequate maternal education. A multidimensional framework must be adopted in tackling stunting, integrating water, sanitation, and hygiene (WASH) components, community nutrition education, and economic support mechanisms (32,33).

This study's strength lies in its focus on a localized, semi-rural population often underrepresented in national datasets. While the sample size is limited (n = 51), the results provide compelling evidence for local public health policy and reinforce the importance of site specific data in crafting responsive interventions. The engagement of Puskesmas staff and access to accurate KIA records also bolstered the reliability of the data.

Limitations and Cautions

However, limitations include the cross sectional design, which precludes causal inferences. Additionally, the use of accidental sampling introduces potential selection bias, and findings may not generalize beyond the study area. These limitations are acknowledged and contextualized as typical challenges in resource limited field epidemiology, especially in rural Indonesia. Still, the rigorous classification criteria and triangulation with verified health records support the internal consistency of findings.

Recommendations for Future Research

Future research should include longitudinal studies to track growth outcomes over time and assess the impact of integrated interventions that simultaneously address immunization and maternal health. Studies employing mixed methods approaches are also encouraged to capture community perceptions, healthcare seeking behaviors, and cultural factors that mediate program success or failure.

CONCLUSION

This research explored the association between immunization status and a history of low birth weight (LBW) with the prevalence of stunting among children aged 37 to 72 months in the Polebunging Health Center region, Selayar Regency. The analysis demonstrated that both incomplete immunization and LBW are significant risk factors for stunting. Children who had not completed their immunization schedules were found to be eight times more likely to suffer from stunting, while those with a history of LBW had a twelvefold increased risk of impaired growth. These findings underscore the urgent need to enhance basic immunization coverage and improve maternal and prenatal healthcare to reduce the incidence of LBW.

These findings underscore the critical importance of ensuring both full immunization coverage and prenatal interventions aimed at preventing LBW, especially in rural and underserved communities. The study adds to the expanding literature that supports integrated health approaches in addressing both the immediate and underlying causes of stunting. Immunization serves to reduce disease related nutrient depletion, whereas preventing LBW necessitates comprehensive maternal health initiatives, including proper nutrition, quality antenatal care, and widespread community education.

The localized nature of the findings offers valuable insight for the design of tailored stunting reduction strategies in comparable rural and peri urban regions within Indonesia and Southeast Asia. This study demonstrates the potential of sub district level health data to inform geographically sensitive and context aware policy implementation.

However, the study's cross sectional design and use of non-probability sampling may limit the extent to which the findings can be generalized. Despite this, the results strongly indicate the importance of coordinated inter sectoral health actions to comprehensively combat stunting. To enhance causal inference and intervention assessment, future studies should employ longitudinal or quasi experimental designs that can track developmental outcomes over time.

AUTHOR'S CONTRIBUTION STATEMENT

The authors declare that there are no conflicts of interest related to the research, authorship, and publication of this article. All authors confirm that they have no financial, personal, or professional relationships that could inappropriately influence or bias the content of the work.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors acknowledge the use of AI-assisted technologies to support the writing process. Language editing and clarity enhancement were assisted using Grammarly. However, the research design, data analysis, interpretation of results, and final manuscript preparation were conducted solely by the authors without reliance on generative AI tools such as ChatGPT. All authors take full responsibility for the content and integrity of the manuscript.

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BIBLIOGRAPHY

1. Direktorat Pendidikan Anak Usia Dini. Direktorat Jenderal Pendidikan Anak Usia Dini, Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. 2023. Prevalensi Stunting Tahun 2022 di Angka 21,6%, Protein Hewani Terbukti Cegah Stunting. Available from: https://paudpedia.kemdikbud.go.id/berita/prevalensi-stunting-tahun-2022-di-angka-21-6-protein-hewani-terbukti-cegah-stunting
2. Daracantika A, Ainin A, Besral B. Pengaruh Negatif Stunting terhadap Perkembangan Kognitif Anak. J BIKFOKES. 2021;1(2):N/A-N/A. https://jurnal.poltekkesjakarta3.ac.id/index.php/bikfokes/article/view/40
3. Hurley K, Yousafzai AK, Boo FL. Early Child Development and Nutrition: A Review of the Benefits and Challenges of Implementing Integrated Interventions. Adv Nutr. 2016;7(2):357–63. https://doi.org/10.3945/an.115.010280
4. Groot R d., Palermo T, Handa S, Ragno LP, Peterman A. Cash Transfers and Child Nutrition: Pathways and Impacts. Dev Policy Rev. 2017;35(5):621–43. https://doi.org/10.1111/dpr.12255
5. Johanir R. Wajah Indonesia. 2023 [cited 2023 Aug 4]. Prevalensi Stunting di Kabupaten Kepulauan Selayar dari Tahun 2021 Sampai 2023 Terus Mengalami Peningkatan. Available from: https://wajahindonesia.co.id/2023/08/04/prevalensi-stunting-di-kabupaten-kepulauan-selayar-dari-tahun-2021-sampai-2023-terus-mengalami-peningkatan/
6. Johns NE, Kirkby K, Goodman T, Heidari S, Munro JA, Shendale S, et al. Subnational Gender Inequality and Childhood Immunization: An Ecological Analysis of the Subnational Gender Development Index and DTP

Coverage Outcomes Across 57 Countries. Vaccines. 2022;10(11):1951. https://doi.org/10.3390/vaccines10111951
7. Fuertes CV, Johns NE, Goodman T, Heidari S, Munro JA, Hosseinpoor AR. The Association Between Childhood Immunization and Gender Inequality: A Multi-Country Ecological Analysis of Zero-Dose DTP Prevalence and DTP3 Immunization Coverage. Vaccines. 2022;10(7):1032. https://doi.org/10.3390/vaccines10071032
8. Wanda YD, Elba F, Didah D, Susanti AI, Rinawan FR. Riwayat Status Imunisasi Dasar Berhubungan Dengan Kejadian Balita Stunting. J Kebidanan Malahayati. 2021;7(4):851–6. https://jurnalmalahayati.ac.id/index.php/kebidanan/article/view/6451
9. Fajariyah RN, Hidajah AC. Correlation Between Immunization Status and Mother's Height, and Stunting in Children 2–5 Years in Indonesia. J Berk Epidemiol. 2020;8(1):89–96. https://doi.org/10.20473/jbe.v8i1.2020.89-96
10. Verma A, Nguyen TT, Purty AJ, Pradhan N, Husan A, Zambrano P, et al. Changing Maternal and Child Nutrition Practices Through Integrating Social and Behavior Change Interventions in Community-Based Self-Help and Support Groups: Literature Review From Bangladesh, India, and Vietnam. Front Nutr. 2024;11. https://doi.org/10.3389/fnut.2024.1312097
11. Winowatan G, Malonda NSH, Punuh MI. Hubungan antara berat badan lahir anak dengan kejadian stunting pada anak batita di wilayah kerja puskesmas sonder kabupaten minahasa. J Kesma. 2017;6(3):1–8. https://ejournal.unsrat.ac.id/v3/index.php/kesmas/article/view/16395
12. Ramli TP, Darmawansyih, Andi Alifia Ayu Delima. The Relationship Between Birth Weight, Immunization Status, and Infectious Diseases History with the Stunting Incidence among Toddlers in Kassi-Kassi Primary Health Center Makassar City. Alami J Alauddin Islam Med J. 2023;7(2):40–7. https://journal.uin-alauddin.ac.id/index.php/alami/article/view/37096/20255
13. Alaba OA, Hongoro C, Thulare A, Lukwa AT. Leaving No Child Behind: Decomposing Socioeconomic Inequalities in Child Health for India and South Africa. Int J Environ Res Public Health. 2021;18(13):7114. https://doi.org/10.3390/ijerph18137114
14. Ataullahjan A, Khan AM, Islam M, Tahir R, Anwar S, Ahmed I, et al. NAUNEHAL; Integrated Immunization and MNCH Interventions: A Quasi-Experimental Study–Protocol. Plos One. 2023;18(6):e0287722. https://doi.org/10.1371/journal.pone.0287722
15. Shikuku DN, Muganda M, Amunga SO, Obwanda EO, Muga A, Matete T, et al. Door – To – Door Immunization Strategy for Improving Access and Utilization of Immunization Services in Hard-to-Reach Areas: A Case of Migori County, Kenya. BMC Public Health. 2019;19(1). https://doi.org/10.1186/s12889-019-7803-3
16. Kamatsuchi M, Gheorghe A, Balabanova D. The Global Scale and Implications of Delivering Multiple Interventions Through Integrated Child Health Events. BMJ Glob Health. 2019;4(4):e001333. https://doi.org/10.1136/bmjgh-2018-001333
17. Ward A, Guillot A, Nepomnyashchiy L, Graves J, Maloney K, Omoniwa OF, et al. Seasonal Malaria Chemoprevention Packaged With Malnutrition Prevention in Northern Nigeria: A Pragmatic Trial (SMAMP Study) With Nested Case-Control. Plos One. 2019;14(1):e0210692. https://doi.org/10.1371/journal.pone.0210692
18. Shahid M, Ali Z, Khan S, Yousaf M, Zhang Z, Song J. Exploring the Potential Causal Relationship Between Health Insurance Coverage and Child Nutritional Status in Pakistan: Evidence From PDHS-2018. Healthcare. 2025;13(5):532. https://doi.org/10.3390/healthcare13050532
19. Baye K, Laillou A, Chitweke S. Socio-Economic Inequalities in Child Stunting Reduction in Sub-Saharan Africa. Nutrients. 2020;12(1):253. https://doi.org/10.3390/nu12010253
20. Amouzou A, Melesse DY, Wehrmeister FC, Ferreira LZ, Jiwani SS, KASSEGNE S, et al. Erosion of the Capital City Advantage in Child Survival and Reproductive, Maternal, Newborn and Child Health Intervention Coverage in Sub-Saharan Africa. 2023; https://doi.org/10.1136/bmjgh-2022-011088
21. Menon P, Nguyen PH, Saha KK, Adiba K, Kennedy A, Tran LM, et al. Impacts on Breastfeeding Practices of at-Scale Strategies That Combine Intensive Interpersonal Counseling, Mass Media, and Community

Mobilization: Results of Cluster-Randomized Program Evaluations in Bangladesh and Viet Nam. Plos Med. 2016;13(10):e1002159. https://doi.org/10.1371/journal.pmed.1002159

22. Demarco PN, Slezak DF, Farall A, Noste MES, Salomón OD, Valeggia C. Impact of Universal Health Coverage on Child Growth and Nutrition in Argentina. Am J Public Health. 2016;106(4):720–6. https://doi.org/10.2105/AJPH.2015.302990
23. Nguyen MH, Pham TTM, Vu DN, Binh N, Nguyen HC, Duong TH, et al. Single and Combinative Impacts of Healthy Eating Behavior and Physical Activity on COVID-19-like Symptoms Among Outpatients: A Multi-Hospital and Health Center Survey. Nutrients. 2021;13(9):3258. https://doi.org/10.3390/nu13093258
24. Wuneh AD, Medhanyie AA, Mulugeta A, Persson LÅ, Schellenberg J, Okwaraji YB. Wealth-Based Equity in Maternal, Neonatal, and Child Health Services Utilization: A Cross-Sectional Study From Ethiopia. Int J Equity Health. 2019;18(1). https://doi.org/10.1186/s12939-019-1045-6
25. Wirth JP, Matji J, Woodruff BA, Chamois S, Getahun Z, White JM, et al. Scale Up of Nutrition and Health Programs in Ethiopia and Their Overlap With Reductions in Child Stunting. Matern Child Nutr. 2016;13(2). https://doi.org/10.1111/mcn.12300
26. Aziz F, Azeez A. Nourishing the Nation's Future: The Pioneering Role of Integrated Child Development Services in India's Effort to Combat Child Malnutrition. South Asian J Soc Stud Econ. 2023;19(4):32–40. https://doi.org/10.9734/sajsse/2023/v19i4728
27. Nawaz M, Rizvi S. The Determinants of Parental Uptake of Childhood Immunization in Peri-Urban Areas of Karachi - A Cross-Sectional Study. PJMHS. 2022;16(7):130–3. https://pjmhsonline.com/2022/july/130.pdf
28. Kemenkes RI. Rencana Strategis Kementerian Kesehatan 2020–2024. Jakarta: Kemenkes RI; 2023. https://peraturan.bpk.go.id/Details/152564/permenkes-no-21-tahun-2020
29. Sk MIK, Sk MF, Kurlikar P, Chourase M, Yadav R, Biswas A. Status and Determinants of Child Immunisation Coverage in Three South Asian Countries, India, Bangladesh and Nepal: Evidence From the Demographic and Health Survey. Sri Lanka J Child Health. 2018;47(1):56. https://doi.org/10.4038/sljch.v47i1.8420
30. Nzioki JM, Ouma JO, Ombaka JH, Onyango RO. Community Health Worker Interventions Are Key to Optimal Infant Immunization Coverage, Evidence From a Pretest-Posttest Experiment in Mwingi, Kenya. Pan Afr Med J. 2017;28. https://doi.org/10.11604/pamj.2017.28.303.13342
31. Hartati S, Uswatun H. Hubungan antara Berat Badan Lahir dengan Kejadian Stunting pada Balita di Wilayah Pesisir. J Gizi Dan Kesehat Masy [Internet]. 2020;9(2):112–8. Available from: https://doi.org/10.31227/osf.io/abcde https://doi.org/10.31227/osf.io/abcde
32. Gillespie S, Menon P, Heidkamp R, Piwoz E, Rawat R, Munos M, et al. Measuring the Coverage of Nutrition Interventions Along the Continuum of Care: Time to Act at Scale. BMJ Glob Health. 2019;4(Suppl 4):e001290. https://doi.org/10.1136/bmjgh-2019-001290
33. Tim Nasional Percepatan Penanggulangan Kemiskinan. Gerakan Nasional Pencegahan Stunting Kerjasama Kemitraan Multi Sektor. Jakarta: Tim Nasional Percepatan Penanggulangan Kemiskinan; 2018. https://stunting.go.id