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RESEARCH ARTICLES

Studi Ekologi Stunting dan Determinannya di Indonesia: Analisis Disparitas Berdasarkan SSGI 2024

An Ecological Study and Disparities Analysis of Stunting and Its Predictors in Indonesia Based on SSGI 2024

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Abstract

Stunting still remains a public health problem in Indonesia. Based on Indonesian Nutritional Status Survey (SSGI) 2024, the prevalence of stunting has declined over the past decade but remains high and varies considerably across the 36 provinces. This study aimed to describe ecological patterns and regional disparities in stunting prevalence and its predictors in Indonesia. This ecological study used secondary data from the SSGI 2024, with provinces as the unit of analysis. The dependent variable was provincial stunting prevalence, while independent variables included maternal knowledge, complete basic immunization, standard growth monitoring, iron supplementation, and access to safe drinking water. Bivariate analysis was conducted using scatter plots, and Spearman correlation tests were applied to assess associations. The results revealed clear disparities in stunting prevalence between western and eastern Indonesia, particularly across Sumatra, Java, and Bali. Provinces with higher coverage of complete basic immunization and better access to safe drinking water tended to have lower stunting prevalence. Conversely, higher coverage of growth monitoring was associated with higher stunting prevalence. Three variables were significantly associated with stunting prevalence: complete basic immunization (*p-value* = 0.03), standard growth monitoring (*p-value* = 0.007), and access to safe drinking water (*p-value* = 0.0002). The findings suggest that strengthening basic immunization, growth monitoring, and access to safe drinking water, particularly through optimizing POSYANDU as an integrated maternal and child health service may help reduce stunting prevalence in Indonesia.

Keywords: child nutrition, ecological study, regional disparities, stunting

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Abstrak

Stunting masih menjadi masalah kesehatan masyarakat utama di Indonesia. Berdasarkan Survei Status Gizi Indonesia (SSGI) 2024, prevalensi stunting telah menurun selama dekade terakhir tetapi masih tinggi dan sangat bervariasi di 36 provinsi. Studi ini bertujuan untuk mendeskripsikan pola ekologis dan kesenjangan regional dalam prevalensi stunting dan prediktornya di Indonesia. Studi ekologis ini menggunakan data sekunder dari SSGI 2024, dengan provinsi sebagai unit analisis. Variabel dependen adalah prevalensi stunting di provinsi, sedangkan variabel independen meliputi pengetahuan ibu, imunisasi dasar lengkap, pemantauan pertumbuhan standar, suplementasi zat besi, dan akses terhadap air minum bersih. Analisis bivariat dilakukan menggunakan scatter plot, dan uji korelasi Spearman untuk menilai asosiasi. Hasil penelitian menunjukkan disparitas yang jelas dalam prevalensi stunting antara Indonesia bagian barat dan timur, khususnya di Sumatera, Jawa, dan Bali. Provinsi dengan cakupan imunisasi dasar lengkap yang lebih tinggi dan akses yang lebih baik terhadap air minum bersih cenderung memiliki prevalensi stunting yang lebih rendah. Sebaliknya, cakupan pemantauan pertumbuhan yang lebih tinggi dikaitkan dengan prevalensi stunting yang lebih tinggi. Tiga variabel secara signifikan berhubungan dengan prevalensi stunting: imunisasi dasar lengkap (nilai p = 0,03), pemantauan pertumbuhan standar (nilai p = 0,007), dan akses terhadap air minum bersih (nilai p = 0,0002). Temuan ini menunjukkan bahwa penguatan imunisasi dasar, pemantauan pertumbuhan, dan akses terhadap air minum bersih, khususnya melalui optimalisasi POSYANDU sebagai layanan kesehatan ibu dan anak terpadu, dapat membantu mengurangi prevalensi stunting di Indonesia.

Kata Kunci: *analisis ekologi, gizi anak, kesenjangan regional, stunting*

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Highlight:

- There is a distinct geographic gap in stunting rates across Indonesia, with provinces in the western region tending to have lower stunting prevalence compared to those in the eastern region
- Provinces with extensive coverage of complete basic child immunization and better public access to safe drinking water are proven successful in reducing stunting prevalence in their areas.
- Higher coverage of growth monitoring is associated with a higher recorded number of stunting cases, indicating that more routine weighing and measuring allow childhood malnutrition potential to be detected much faster.

INTRODUCTION

Nutrition in children has a crucial role in growth, development and overall health. Good nutritional status provides a strong foundation for optimal growth, cognitive development, immune function, and long-term health. In early life, this need becomes even more crucial because growth and development occur so rapidly (Johnson, 2024). However, *nutrition in children has been facing some challenges* in developing country, such as stunting.

Stunting is a condition when children have impaired growth and development

that children experience due to poor nutrition, repeated infection, and the lack of psychosocial stimulation. Children are determined as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median. Stunting during early life has adverse functional effects on the child. Some of those long-term effects, such as poor cognition and educational performance, low wages in their adulthood, low productivity and, when accompanied by excessive weight gain later in childhood, risk of nutrition-related chronic diseases are increasing in adult life (WHO, 2015).

World Health Organization (WHO) stated that 23,2% of all children under 5 years were stunted in 2024 (WHO, 2025). Southeast Asia contributes to more than 25% of the stunted children in the world, which is from 11 countries. Seven of those countries have a stunting prevalence above the global average. Timor Leste has the highest prevalence of stunting (48.8%), followed by Indonesia (31.8%), Laos (30.2%), Cambodia (29.9%), Philippines (28.7%), Myanmar (25.2%), and Vietnam (22.3%) (UNICEF et al., 2025). According to the Indonesian Nutritional Status Survey (SSGI) 2024, the prevalence of stunting remains quite high, although its rate decreases nowadays. The prevalence of stunting reached 37.6% in 2013, decreasing to 19.8% in 2024 based on national survey data. The prevalence of stunting in Indonesia differs considerably across regions. Most provinces in western Indonesia have relatively low prevalence rates, at less than 20%. Central Indonesia tends to have a higher prevalence rate than the western region, with a prevalence rate exceeding 20%, with East Nusa Tenggara province having the highest prevalence rate at 37% and Bali having the lowest prevalence rate in Indonesia (8.7%). Eastern Indonesia tends to have a relatively high prevalence rate, with the Papua Highlands province having the highest prevalence rate at 40%. This figure is the highest in Indonesia. Therefore, it can be concluded that there is a clear gradient in stunting incidence across regions in Indonesia. The further east you go, the higher the stunting rate (Kemenkes, 2025).

Several factors are suspected to be predictors related to the incidence of stunting in Indonesia, such as knowledge, complete basic immunization, standard growth monitoring, iron supplementation and also environmental factors namely access to safe drinking water. Knowledge plays a crucial role in stunting prevention efforts. Knowledge about stunting, its causes, prevention, and balanced nutrition can help reduce incidence of stunting (Adam et al., 2024; Hall et al., 2018; Wahyuni et al., 2024). Since infectious diseases can affect children's growth, efforts to prevent and manage these illnesses, such as immunization programs, are important for supporting optimal growth in children (Prendergast, 2015). In addition, basic immunization status has been shown to affect the occurrence of stunting among children under fives aged 12–59 months (Purwanti et al., 2025).

Growth monitoring is practiced worldwide. In Indonesia standard growth monitoring were routine measurement of weight (children under fives' weight is monitored at least 8 times a year) and height (children under fives' height is monitored at least 2 times) in the past 12 months. The coverage in Indonesia is 65,4% in 2024 and this is still below the target. Growth monitoring is aimed to improve and maintain child health and nutrition. Up to now, this strategy is the best way to block malnutrition worldwide (Liu et al., 2023).

Besides children's factors, iron supplementation to mothers need to assess. Women's nutrition, especially before and during pregnancy, is crucial. Iron deficiency accounts for nearly half of all maternal anemia cases worldwide (Haider et al., 2013). However, indirect determinants such as quality and access of water, sanitation, and

personal hygiene such as hand-washing habit can also related to stunting prevalence (BAPPENAS and UNICEF, 2017). It is important to investigate the disparities of stunting prevalence and its predictors including children under five intervention (basic immunization and growth monitoring), mothers factor (knowledge and iron supplementation during pregnancy) and access to safe drinking water.

METHODS

This research employed a non-experimental design using an ecological analysis approach, also known as an aggregate study (Nurrizka and Wahyono, 2018). The study utilized secondary data from the *Survei Status Gizi Indonesia 2024* (Indonesian Nutritional Status Survey 2024) published by the *Kementerian Kesehatan Indonesia* in 2025. Ecological analysis enables researchers to examine the broad effects of specific policies or interventions on population health within a particular region (Laksono and Kusrini, 2020). The survey report is publicly accessible through the official website of the Indonesian Ministry of Health at https://www.badankebijakan.kemkes.go.id/survei-status-gizi-indonesia-ssgi-2024/. Provinces served as the unit of analysis in this study, involving data from 36 provinces across Indonesia. The SSGI 2024 survey received ethical approval from the Health Research Ethics Committee of Health Polytechnic Kemenkes Jakarta II with ethical clearance number DP.04.03/1/KE/L/230/2024. During data collection, informed consent procedures were implemented to ensure voluntary participation, confidentiality, and transparency regarding the data collection process.

The dependent variable in this study is "Prevalence of Stunting in the Province". Stunting is described by a Z-score of height for age is <-2.0. There are 5 independent variables that are projected as predictors, namely knowledge, complete basic immunization, standard growth monitoring, iron supplementation and access to safe drinking water. Knowledge variables was a proportion of mothers or caregiver who have a good knowledge and attitude towards stunting issue. Complete Basic Immunization variables were proportion of children who received basic immunization based on Indonesian Maternal and Child Health Book. Standard growth monitoring is a proportion of children under 5 years who receive weight and length measurement. Growth monitoring is considered standard if children have had ≥8 weight measurements and ≥ 2 length/height measurements in the last 12 months. Iron supplementation is a proportion of mothers who receive iron supplementation while pregnant from health services or buy it by herself. Access to safe drinking water is a proportion of household who have access to protected source of water.

The analysis was conducted using bivariate analysis by entering the independent and dependent variables into a scatter plot. Statistical analysis using the Spearman correlation test to confirm the relationship between the two variables.

The limitations of the study are the usage of aggregate data therefore this study is unable to describe individual situation. The study also unable to explore each variable deeper due to availability of data showed at SSGI 2024 report.

RESULTS AND DISCUSSIONS

Figure 1 shows distribution of stunting's prevalence in each province in Indonesia. According to Presidential Regulation of Republic of Indonesia Number 72 of 2021, it is targeted by 2024, the stunting prevalence must be reduced to 14%[16]. There

are only 3 provinces out of 36 provinces in Indonesia that close the target. Some provinces have reached very low prevalence, far below the national average. Bali has the lowest rate with a prevalence of only 8.6%, followed by East Java (14.7%) and the Riau Islands (15%) (marked in white). On the other hand, significant challenges are still faced by several provinces with very high stunting prevalence. Southwest Papua has a prevalence of 30.5%, West Sulawesi 35.4%, and the highest is East Nusa Tenggara (NTT) at 37% (marked in black). This figure also indicates the wide disparities prevalence of stunting in Indonesia.

Figure 1. Distribution of stunting rate across all province in Indonesia in 2024

Table 1. Descriptive statistics of stunting rate and all related variables

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Knowledge	36	0	8.2	0.889	1.4530
Iron supplementation	36	66.9	96.4	82.736	8.5123
Complete basic immunization	36	5.4	89.5	47.089	19.0204
Standard growth monitoring	36	35.1	81.3	57.508	11.2418
Access to safe drinking water	36	73.1	99.5	90.806	6.2557
Prevalence of Stunting	36	8.6	37.0	22.258	57.508

Note: Secondary data, 2025 (Source: SSGI 2024)

Knowledge

Figure 2 shows the scatter plot of stunting prevalence and mothers's knowledge variables. For the knowledge, it can be seen that the more motherss have correct knowledge regarding stunting, the lower the stunting prevalence in an area. The linear regression test indicates that knowledge variable is not statistically significant associated with stunting prevalence (*p-value* = 0,572 > 0,05).

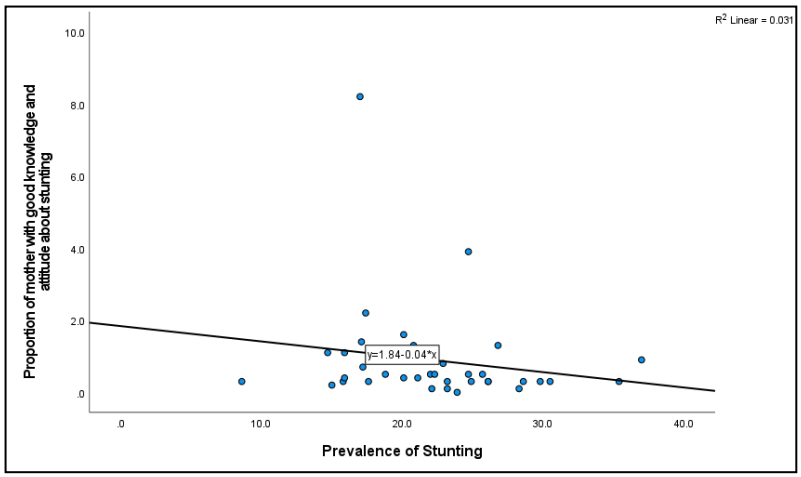

Figure 2. Scatter plot of knowledge and stunting prevalence in Indonesia

Complete basic immunization

Figure 3 reveals the scatter plot between complete basic immunization variable and stunting prevalence. It shows that the more children receive complete basic immunization, the lower prevalence of stunting. The statistical analysis shows that there is significant correlation between stunting prevalence and complete basic immunization (*p-value* = 0,03 < 0,05).

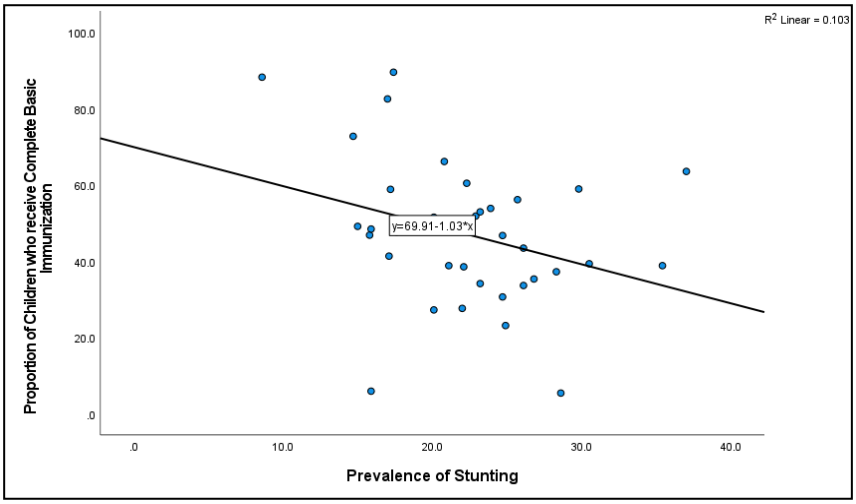

Figure 3. Scatter plot of complete basic immunization and stunting prevalence in Indonesia

Standard growth monitoring

Figure 4 shows the scatter plot between standard growth monitoring and stunting prevalence. The plot shows that the higher the proportion of children who get standard growth monitoring the bigger stunting prevalence is. This is a positive correlation but inadequate (R2 = 0,0027). Meanwhile the statistical analysis shows that growth monitoring has significant correlation with stunting prevalence (*p-value* = 0,007<0,05).

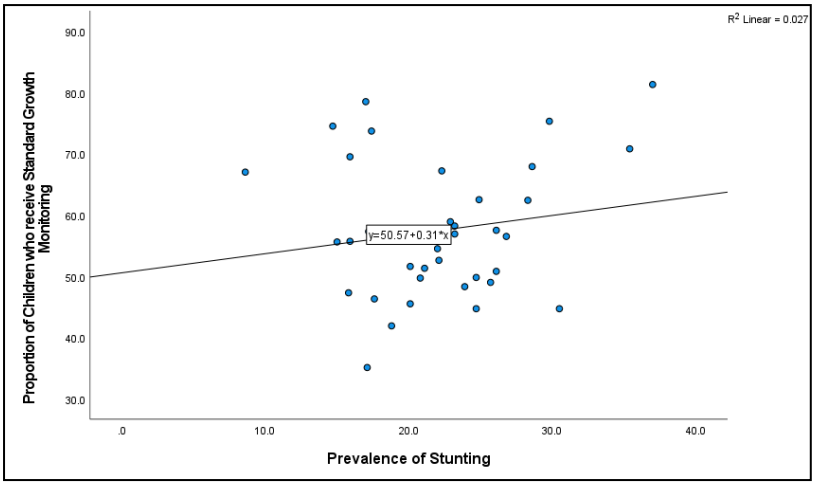

Figure 4. Scatter plot of standard growth monitoring and stunting prevalence in Indonesia

Iron supplementation

Figure 5 performs the scatter plot of iron supplementation and stunting prevalence. It presents that the more proportion of mothers who accept iron supplementation the lower stunting prevalence. The statistical analysis results that there is no significant relationship between iron supplementation and stunting prevalence (*p-value* = 0,512 > 0,005).

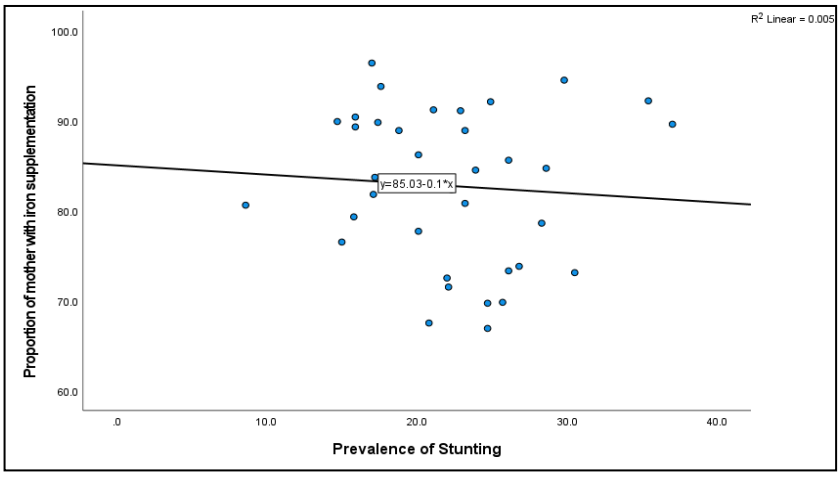

Figure 5. Scatter plot of iron supplementation for mothers and stunting prevalence in Indonesia

Access to safe drinking water

Figure 6 shows the scatter plot of stunting prevalence and access to safe drinking water. It shows that greater access to safe drinking water, the lower the stunting prevalence in the area. The linear regression test indicates that safe drinking water access has significant correlation with stunting prevalence (*p-value* = 0,002 < 0,005)

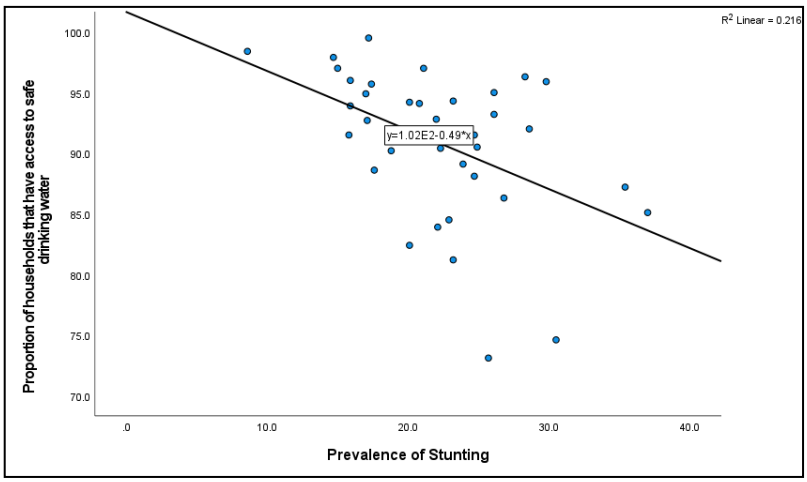

Figure 6. Scatter plot of access to safe drinking water and stunting prevalence in Indonesia

Disparities analysis among region

Several regions in Indonesia have disparities in stunting prevalence. The highest prevalence of stunted children under five is located at East Nusa Tenggara province (37%). Bali, East Java, and Riau have the lowest prevalence of stunting in children under fives. Our finding is consistent with previous study that health improvement in the West (Sumatra, Java-Bali) has a better propensity than in Eastern Indonesia (Kusrini dan Laksono, 2020; Laksono et al., 2020). This research also reveals that province with good proportion of basic immunization coverage, children under fives' regularly growth monitoring and consume a good access of safe drinking water were have the lower stunting prevalence.

The relationship between stunting and its predictors

Health knowledge and literacy refer to the abilities that allow individuals to access, comprehend, evaluate, and apply health information in making decisions and taking actions that influence their health status. Nevertheless, literacy and knowledge do not always directly correlate with health outcomes. Individuals with high levels of health literacy may still face difficulties in applying their knowledge in unfamiliar situations or when interacting with intimidating individuals (Nutbeam and Llyoid, 2021). Nutrition literacy and knowledge are associated with various aspects of child health, including infant and young child feeding practices, the selection and preparation of nutritious foods, child growth and development, stunting prevention, access to healthcare services, food security, and understanding of traditional food nutrition (Wahyuni et al., 2024). Previous research identified a relationship between maternal nutritional knowledge and stunting prevalence, showing that respondents with poor nutritional knowledge had a 0.246-times greater risk of having stunted children compared to those with good nutritional knowledge (Aprilina et al., 2021). In contrast, the findings of the present study differ from those results. This may suggest that adequate maternal knowledge regarding stunting alone is insufficient to improve children's nutritional status unless it is accompanied by nutritional knowledge, healthy food practices, positive attitudes, well-developed personal skills, and consistent growth-monitoring practices.

Blum's theory emphasizes the role of behavior and social systems in determining health status. The theory performed interaction between environment, behavior, health access and also genetic. Basic immunization, standard growth monitoring and also iron supplementation are categorized as accessible program to all mothers and children in Indonesia. An adequate implementation and utility of these factors may increase health status of children in Indonesia (Maida, 2025). In this research, basic immunization i s significantly correlated with stunting prevalence. Scatter plot shows that province with higher children who received complete basic immunization, the lower prevalence of stunting. These findings are consistent with previous studies showing that stunting is associated with basic immunization status, where children under fives aged 12–59 months who received incomplete or no basic immunization were at greater risk of stunting compared to those who completed the recommended immunization schedule (Purwanti et al., 2025). Immunization has also been identified as an important factor in preventing stunting among children aged 1–5 years (Theresia and Sudarma, 2022). Earlier studies explain that immunization contributes significantly to the development of a child's immune system. Children who receive complete immunization generally have stronger immunity, enabling them to better resist infectious diseases (Sari et al., 2021). In addition, vaccines may produce non-specific protective effects that enhance overall child health and help lower the risk of stunting. These effects are thought to occur through mechanisms such as innate immune memory, also referred to as trained immunity, and lymphocyte cross-reactivity (Berendsen et al., 2016; Flanagan et al., 2013).

Growth measurement is statistically significant with stunting prevalence, but research's scatter plot performs the more province with high proportion of children who get standard growth monitoring the bigger stunting prevalence is. This is a positive correlation but inadequate (R^2 = 0,0027). It is possible because the more regularly someone monitors their growth and development, the sooner they can identify the potential of malnutrition. Therefore, growth monitoring serves an important role in supporting child development. Widely implemented around the world, standard growth monitoring involves routinely measuring a child's weight and recording it on a growth chart. This process enables the continuous assessment of a child's growth pattern by comparing it with established anthropometric standards. Growth monitoring is commonly accompanied by health promotion activities, including counselling and interventions aimed at improving child growth, since weighing and charting alone are not sufficient to enhance growth outcomes. In Indonesia, this activity includes in program namely Integrated Service Post *(POSYANDU - Pos Pelayanan Terpadu)*. The Posyandu model supports community participation, health education, and early health screening. Its implementation has been associated with several positive outcomes, including higher utilization of antenatal care services, increased rates of exclusive breastfeeding, improved immunization coverage, and a decline in stunting prevalence (Masriawan and Ariadi, 2025). Similarly, a study conducted in West Java, Indonesia, found that more frequent visits to Posyandu were linked to better nutritional status among children (Anwar et al., 2010).

Our finding about correlation between stunting and iron supplementation is consistent with those of China and Sub-Saharan Africa (Wang et al., 2012; Traore et al., 2023). Prenatal iron supplementation plus deworming or iron supplementation (with or without deworming) were not associated with childhood anemia, infant stunting and low birth weight. In contrast, this research is an aggregate study which maybe can loss individual detail.

Social determinants of health (SDOH) are social resources and system that construct health outcomes. Many areas considered part of SDOH such as economic situation, wages and taxes, transportation, housing, and education have not traditionally been seen as within the authority of public health (Hahn, 2021). Safe drinking water access is considered as a consequent of housing and education. As part of SDOH, this factor may affects health status in society. In this research, Province with good access to safe drinking water will have lower prevalence of stunting and it is significantly correlated (*p-value* = 0,002 < 0,05). This result is consistent with research's findings in West Java that there are significant association on the incidence of stunting with access to safe drinking water (Novianti et al., 2023). Clean drinking water refers to water that is safe for human consumption. Based on physical characteristics, good-quality water should be clear, tasteless, odorless, and colorless. Children under fives who consume contaminated water, such as water that appears cloudy or discolored, are more likely to experience diarrhea (Raharini and Yuniarti, 2023). Study about water sanitation in Indonesia have similarities with study in Ethiopia which is exposed that drinking water sources correlated with incidence of stunted children under five (Kwami et al., 2019).

CONCLUSIONS

There are disparities of stunting prevalence in West and East of Indonesia. Health development is proclivity spread on West Indonesia (Java Bali-Sumatra). Some of significant predictors of stunting prevalence were complete basic immunization, standard growth monitoring and access to safe drinking water (*p-value* ≤ 0,05). This leads into an assumption that encouraging region with low coverage of basic immunization, growth monitoring and safe to access drinking water by optimizing *POSYANDU* as a holistic service to mothers and children will reduce stunting prevalence in province.

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CONFLICT OF INTEREST

There is no conflict of interest in this article

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