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IS DESIRABLE DIETARY PATTERN (DDP) RELATED TO STUNTING IN INDONESIA?

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Abstract: Indonesia is still struggling with stunting as a public health problem. Food consumption patterns are one of the direct factors that influence nutritional problems. The unbalanced diet of Indonesian people yet, as indicated by the Desirable Dietary Pattern (DDP) score, potentially renders nutritional problems. The study aims to analyze the relationship between DDP score and stunting prevalence during 2018-2022 in Indonesia. This quantitative study used a cross-sectional design and secondary data, including DDP scores from the National Food Agency and stunting prevalence among children aged 0−59 months from various Indonesian surveys (2018−2022). The DDP score, reflecting dietary diversity and nutritional balance, is calculated based on energy consumption and food group percentages. Analysis over five years showed a negative correlation between DDP scores and stunting prevalence ($p<0.05$) through linear regression. DDP score increase is related to reducing the prevalence of stunting. These findings can serve as a foundation for developing policies and interventions at both the national and provincial levels, focusing on preventing stunting by encouraging the consumption of diverse and balanced foods. Improving the quality of food consumption through increasing food affordability and the availability of healthy and nutritious food plays an important role in increasing the DDP score and overcoming stunting. Policy measures should prioritize increasing access to affordable and nutritious food while also raising public awareness about the importance of a balanced diet. Additionally, practical efforts such as nutrition education, community-based food initiatives, and incentives to boost local food production can play a vital role in effectively reducing stunting prevalence.

Keywords: child nutrition, desirable dietary pattern, food consumption, Indonesia, public health, stunting

Introduction

In 2022, it was estimated that 22.3 percent or 148.1 million children under the age of five were stunted globally. Over half of the world's stunted children are in Asia (76.6 million), and around 1 in 5 children under five were stunted in Indonesia with the prevalence of stunting was 21.6 percent in 2022 (Kemenkes, 2023; UNICEF et al., 2023).

The imbalance in food consumption and the lack of food diversity partly contribute to the high level of global and national nutritional issues (Hardinsyah, 2007; WHO and FAO, 2014). The World Health Organization (WHO) recommends a comprehensive dual-task action approach to address nutrition and public health issues. One of these efforts can be done through various interventions, programs, and

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environmental policies, which focus on providing access to healthy and nutritious food, including an approach to preventing diet-related NCDs by improving diet quality (WHO, 2017).

Indonesia faces ongoing challenges with stunting as a public health issue. One contributing factor is the population's dietary patterns, where an unbalanced diet, reflected by the Desirable Dietary Pattern (DDP) score, can lead to nutritional problems (Hardinsyah, 2007; UNICEF et al., 2023).

DDP developed by FAO-RAPA to measure the diversity and quality of food consumption and availability, especially for countries in the Asia-Pacific Region (FAO, 1989). The DDP score is one of the indicators to measure the quality of regional food consumption as one of the Food Security Development Indicators. The maximum DDP score of 100 indicates a situation of diverse food consumption, nutritional and balanced (Badan Ketahanan Pangan, 2020; Bappenas RI, 2019).

The data-driven analysis of Indonesian food consumption trends from 2018 to 2022, based on the Desirable Dietary Pattern (DDP), indicates that the intake of carbohydrates (cereal and added fat/oil) exceeds the recommended level (over 50% of the Recommended Dietary Allowance/%RDA). Conversely, the consumption of tubers, legumes, vegetables, and fruits falls below the %RDA. This suggests that dietary diversity does not meet the standards of the Desirable Dietary Pattern (DDP) during the period of 2018-2022 (Badan Ketahanan Pangan, 2020).

A systematic review and meta-analysis identified food insecurity as a significant risk factor for stunting in Indonesia, with a prevalence odds ratio of 2.00 (95% CI: 1.37-2.92) (Gusnedi et al., 2023). Moreover, a study found that Indonesian children aged 6 to 23 months lack dietary diversity, with low protein and vitamin intakes and high carbohydrate consumption, contributing to the double burden of malnutrition (Ramadhan et al., 2019). Beal et al. (2017) underscored the critical role of secondary data analysis in identifying the factors contributing to child stunting, thereby facilitating the development of targeted interventions. Given the significant regional disparities in stunting rates, it is imperative to concentrate efforts on areas with the highest prevalence.

Previous research has examined the relationship between Desirable Dietary Pattern (DDP) scores and stunting in children under-five, but most of these studies focused on one village or district, resulting in inconsistent findings. Several studies at the sub-district level showed a correlation, while analyses at the district and provincial levels found no correlation (Amarita, 2022; Ngaisyah, 2017; Rohmawati et al., 2022). To date, there has been no research investigating the relationship between DDP and stunting using national-level data over time. This highlights the need for further research. Therefore, this study aims to analyze the diversity of food consumption based on DDP scores at the national level, using data from all provinces related to stunting prevalence in Indonesia from 2018 to 2022.

Materials and Methods

This study used secondary data DDP scores from the National Food Agency and data on stunting prevalence among children aged 0−59 months from Basic Health Research 2018, Indonesia Child Nutrition Status Survey 2019, stunting prevalence published data 2020 from the Secretariat of the Vice President Indonesia and Indonesia Nutritional Status Survey 2021-2022 (Kemenkes, 2018; SSGI, 2023). This study uses cross-sectional study design using data time series from 2018-2022.

The Desirable Dietary Pattern (DDP) is determined by the energy derived from nine food groups: cereals, tubers, animal foods, oils and fats, oily fruits or seeds, legumes, sweets, vegetables and fruits, spices, and beverages. This is measured against the average recommended energy intake of 2100 calories per person per day. The DDP score calculation refers to the Guidelines for Calculating a Desirable Dietary Pattern from the National Food Agency. The data on energy consumption is sourced from a recall of information gathered by the Statistic of Indonesia a week prior. The prevalence of stunting is the percentage of children under five years old who are two standard deviations below the expected height for their age (Z-score for height according to age ≥ -3.0 to a Z-score < -2.0 expressed as a percentage) (Kemenkes, 2023).

The data structure being studied includes provincial and national levels, each with a total of 35 records for each year from 2018 to 2022. The variables under observation in this study are stunting variables at both provincial and national levels, which serve as the dependent variable, and the DDP score, which serves as an independent variable at both provincial and national levels. Thus, this study hypothesizes whether the DDP score correlates with stunting prevalence children under-five.

This study presents several limitations regarding its data sources. There is a potential for aggregation bias in national-level data, which may obscure regional disparities and complicate the ability to draw accurate conclusions about specific demographic groups. Additionally, temporal bias may be an issue due to discrepancies in the timing of data collection between the DDP and the prevalence of stunting. Moreover, the study did not consider several significant confounding factors related to child stunting, including maternal height and education, preterm birth, exclusive breastfeeding for six months, and household socioeconomic status.

The statistical analysis used in this study includes descriptive and inferential analyses. Descriptive analysis was used to explore the data for each variable studied, while inferential analysis utilized linear regression with a following equation:

$$Y_i = \beta_0 + \beta_1 X_1 \ldots\ldots\ldots\ldots\ldots \text{ where, } Y_i: Stunting\ Prevalence; X_1: the\ DDP\ Score$$

Kolmogorov-Smirnov test was used to check the normality of the data (residual values were checked for normal distribution). Data processing and analysis were conducted using MS Excel and IBM SPSS 25.0.

Results and Discussion

An overview of percentage of stunted children under five and trend of dietary diversity based on DDP score is shown in Table 1. The standard deviation values suggest variability in stunting prevalence across the sample, and the standard deviation remains relatively stable, indicating consistent variability in the scores. There is a general decreasing trend in the mean stunting prevalence from 2018 to 2022, indicating an improvement in nutritional status over these years. The mean DDP score shows a slight increase over the years, suggesting an improvement in dietary patterns.

Table 1: Descriptive statistics of variables included in the study

Variable	N	Minimum-Maximum	Mean	Std. Deviation
Stunting Prevalence (2018)	35	17.6-42.7	30.27	5.22
DDP Score (2018)	35	64.3-95.1	82.30	6.43
Stunting Prevalence (2019)	35	14.4-43.8	27.94	6.22
DDP Score (2019)	35	65.9-94.4	82.89	6.27
Stunting Prevalence (2020)	35	13.7-43.0	26.80	6.37
DDP Score (2020)	35	67.9-94.3	82.72	6.06
Stunting Prevalence (2021)	35	10.9-37.8	25.19	6.10
DDP Score (2021)	35	70.7-95.3	82.61	5.54
Stunting Prevalence (2022)	35	8.0-35.3	23.24	6.38
DDP Score (2022)	35	73.7-96.2	86.64	6.39

Source: National Food Agency (2022), Kemenkes (2018, 2022) processed

The level of dietary diversity can be assessed using various indicators, with one of them being the Desirable Dietary Pattern (DDP) score. An increase in the DDP score indicates a more varied food intake among the population, moving towards better nutritional balance. The rise in the national DDP score between 2018 and 2022 suggests that the score is approaching the ideal value of 100, signifying an improvement in the quality of food consumption and nutritional balance. Several studies also demonstrate a strong link between diverse food consumption and a healthy diet (Arimond & Ruel, 2004; Conklin et al., 2016; Verger et al., 2021).

Table 2 shows that all p-values are less than 0.05, suggesting that the relationships observed are statistically significant, and the negative (r) values indicate a negative correlation between the DDP score and stunting prevalence for all years. The DDP score 2018-2022 was negatively correlated with stunting prevalence. DDP score increase is related to reducing the prevalence of stunting.

The relationship between DDP scores and stunting prevalence, as shown in Table 2, indicates that one way to prevent and manage stunting in Indonesia is by promoting diverse food consumption from an early age. A systematic review and meta-analysis of risk factors for stunting prevalence in Indonesia revealed that food insecurity is the main risk factor for stunting in households and communities (POR 2.00, 1.37-2.92). The study results also underscored the significance of a nutrition program approach to further improve the factors contributing to stunting in Indonesia (Gusnedi et al., 2023).

DDP serves as a measure of nutritional balance and food diversity that is relevant for reducing stunting. Several studies also demonstrate a close relationship between food consumption diversity and nutrition and health (Cena & Calder, 2020; Qu et al., 2022). Enhancing the consumption of a variety of foods according to the Desirable Dietary Pattern is a crucial preventive measure to reduce the prevalence of stunting. Improving the quality of food intake through increased affordability and access to healthy, nutritious food is a key factor in elevating DDP scores as part of efforts to reduce stunting prevalence.

Table 2: Result of Linear Regression Test with Stunting Prevalence as Dependent Variable

Variable	r	R^2	Linear Model	P-value

DDP Score (2018)	-0.462	0.213	99.528-0.569DDP	0.005
DDP Score (2019)	-0.436	0.190	95.194-0.440DDP	0.009
DDP Score (2020)	-0.481	0.231	94.963-0,457DDP	0.003
DDP Score (2021)	-0.639	0.409	100.321-0.703DDP	0.000
DDP Score (2022)	-0.638	0.407	101.522-0.640DDP	0.000

Source: National Food Agency (2022), Kemenkes (2018, 2022) processed

Food quality and various aspects of agriculture and food systems, including food production, processing, and the availability of micronutrient-rich foods, are key determinants of stunting in Indonesia. The policy analysis reveals progress alongside some gaps. Indonesia still faces challenges in enhancing and diversifying food production to improve nutrition and achieve more balanced diets. (Beal et al., 2018; World Bank, 2022).

Contributing factors include political and economic influences, such as food prices, trade policies, and access to employment; health-related elements like access to health services and qualified providers; and educational aspects, which emphasize the need for quality education and infrastructure. Additionally, water, sanitation, and environmental factors, including infrastructure and climate change, play a significant role in addressing stunting. The reviewed literature indicates that stunting is not solely a malnutrition issue, but a complex problem involving multiple factors. Key contributors to stunting in toddlers include low maternal education, inadequate knowledge of child nutrition, and parenting practices such as exclusive breastfeeding and proper complementary foods (MP-ASI). Other factors include a history of low birth weight (LBW), infectious diseases like respiratory infections (ISPA) and recurrent diarrhoea, poor environmental sanitation, and low socioeconomic status. (Beal et al., 2018; Nofitasari et al., 2022; Ramadhan et al., 2019; World Bank, 2022). Addressing these factors is essential for developing effective strategies to combat stunting in children.

The findings of this study are expected to serve as a reference for future research aimed at reducing stunting prevalence in Indonesia, the evaluation of tailored dietary interventions that support Desirable Dietary Pattern (DDP), and specifically targeting stunting prevalence based on regional and agroecological contexts. Additionally, further studies be able to focus on assessing community-based programs, including nutrition education and local food diversification. These efforts should be complemented by government initiatives, such as subsidized food programs and food fortification, to enhance dietary diversity and subsequently reduce stunting rates. Moreover, it is important to conduct further research on regional disparities in DDP and stunting prevalence. This will help identify specific challenges and develop targeted interventions that are culturally and economically relevant to diverse regions.

Conclusion

The issue of stunting is complex and multifaceted. To address stunting in Indonesia, multiple sectors have been engaged, with a focus on targeted interventions. Following the Desirable Dietary Pattern, promoting dietary diversity is considered a crucial strategy to prevent and reduce stunting prevalence in Indonesia. Food and nutrition development policies in Indonesia need to be demand-driven,

promoting diverse food consumption patterns to enhance nutrition as a preventative measure for public health.

This study acknowledges several limitations related to its data sources. There is a risk of aggregation bias in national-level data, which may mask regional disparities. Further research is needed to examine regional differences in the prevalence of dietary diversity and stunting. This research will help identify specific challenges and develop targeted interventions that are culturally and economically relevant to diverse areas. Efforts should be systematically organized to improve dietary habits and ensure the availability of a variety of affordable foods for everyone. Additionally, there must be a political commitment to reducing stunting as part of the 2030 agenda.

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Declaration of Interest Statement

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Amarita, M. (2022). Keterkaitan pola pangan harapan (PPH) dengan kejadian stunting pada balita. *Jurnal SAGO Gizi Dan Kesehatan*, *3*(1), 7. https://doi.org/10.30867/gikes.v3i1.300

Arimond, M., & Ruel, M. T. (2004). Dietary diversity is associated with child nutritional status: Evidence from 11 demographic and health surveys. *Journal of Nutrition*, *134*(10), 2579–2585. https://doi.org/10.1093/jn/134.10.2579

Badan Ketahanan Pangan. (2020). Laporan Kinerja Badan Ketahanan Pangan. In *BKP*.

Bappenas RI. (2019). *Ringkasan eksekutif: Rencana Pembangunan Jangka Menengah Nasional (RPJMN) 2020-2024*. *April 2009*, 1–13.

Beal, T., Tumilowicz, A., Sutrisna, A., Izwardy, D., & Neufeld, L. M. (2018). A review of child stunting determinants in Indonesia. *Maternal and Child Nutrition*, *14*(4), 1–10. https://doi.org/10.1111/mcn.12617

Cena, H., & Calder, P. C. (2020). Defining a healthy diet: Evidence for the role of contemporary dietary patterns in health and disease. *Nutrients*, *12*(2), 1–15. https://doi.org/10.3390/nu12020334

Conklin, A. I., Monsivais, P., Khaw, K. T., Wareham, N. J., & Forouhi, N. G. (2016). Dietary Diversity, Diet Cost, and Incidence of Type 2 Diabetes in the United Kingdom: A Prospective Cohort Study. *PLoS Medicine*, *13*(7), 1–16. https://doi.org/10.1371/journal.pmed.1002085

Gusnedi, G., Nindrea, R. D., Purnakarya, I., Umar, H. B., Andrafikar, Syafrawati, Asrawati, Susilowati, A., Novianti, Masrul, & Lipoeto, N. I. (2023). Risk factors associated with childhood stunting in Indonesia: A systematic review and meta-analysis. *Asia Pacific Journal of Clinical Nutrition*, *32*(2), 184–195. https://doi.org/10.6133/apjcn.202306_32(2).0001

Hardinsyah. (2007). Review on Determinant Factors of Dietary Diversity. *Jurnal Gizi Dan Pangan*, *2*(2), 55–74.

Kemenkes. (2018). Laporan_Nasional_RKD2018_FINAL.pdf. In *Badan Penelitian dan Pengembangan Kesehatan* (p. 198). http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf

Kemenkes. (2023). Survei Kesehatan Indonesia. In *Survei Kesehatan Indonesia (SKI) 2023 Dalam Angka* (Vol. 01).

Ngaisyah, R. D. (2017). Keterkaitan Pola Pangan Harapan (Pph) dengan Kejadian Stunting Pada Balita. *Jurnal Kedokteran Dan Kesehatan*, *13*(1), 71. https://doi.org/10.24853/jkk.13.1.71-79

Nofitasari, A., Madjid, R., Nikoyan, A., Taufik, Y., Waluya, U. M., & Haluoleo, U. (2022). *Economic Status , Maternal Parenting , and Dietary*. *20*(6), 4862–4874. https://doi.org/10.14704/nq.2022.20.6.

Qu, X., Na, X., Yang, J., Yu, H., Chen, A., & Zhao, A. (2022). Reaching and maintaining higher dietary diversity is associated with decreased risk of all-cause mortality: A longitudinal study from the China Health and Nutrition Survey. *Frontiers in Nutrition*, *9*. https://doi.org/10.3389/fnut.2022.947290

Ramadhan, A., Ana, F., & Tamyis, R. (2019). *Sirojuddin Arif Widjajanti Isdijoso Strategic Review of Food Security and Nutrition in Indonesia*.

Rohmawati, N., Hidayati, M. N., & Jannah, M. (2022). Hubungan Skor Pola Pangan Harapan (PPH) dengan Kejadian Stunting Pada Balita Usia 24-59 Bulan. *Jurnal Nutrisia*, *24*(1), 8–15. https://doi.org/10.29238/jnutri.v24i1.248

SSGI. (2023). Hasil Survei Status Gizi Indonesia. *Kementerian Kesehatan Republik Indonesia*, 77–77. https://promkes.kemkes.go.id/materi-hasil-survei-status-gizi-indonesia-ssgi-2022

UNICEF, WHO, & WORLD BANK. (2023). Level and trend in child malnutrition. *World Health Organization*, 4. https://www.who.int/publications/i/item/9789240073791

Verger, E. O., Le Port, A., Borderon, A., Bourbon, G., Moursi, M., Savy, M., Mariotti, F., & Martin-Prevel, Y. (2021). Dietary Diversity Indicators and Their Associations with Dietary Adequacy and Health Outcomes: A Systematic Scoping Review. *Advances in Nutrition*, *12*(5), 1659–1672. https://doi.org/10.1093/advances/nmab009

WHO. (2017). *Double-duty actions to address all form of malnutrition: from evidence to programmes and policy*. https://covid19.go.id/

WHO and FAO. (2014). International Conference on nutrition. *World Health Forum*, *14*(2), 207–209.

World Bank. (2022). Moving Forward : How Indonesia's Districts Reduce Stunting. *Stunting.Go.Id*, 1–1.