

PowerPoint versus Leaflet Delivery of "CEMAS" Nutrition Education for Mothers of Stunted Children: A Quasi-Experimental Study in Balikpapan, Indonesia

Lale Harwindi Silviana¹, Nur Abri^{1*}, Satriani¹, Dwi Hendriani²

¹ Department of Nutrition and Dietetics, Poltekkes Kalimantan Timur, Indonesia

² Department of Health Promotion, Poltekkes Kalimantan Timur, Indonesia

Corresponding Author Email: abrijoto05@gmail.com

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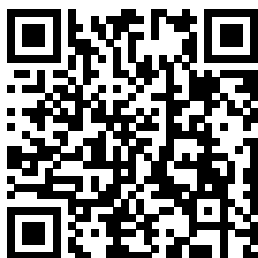
ABSTRACT

To compare the effect of "CEMAS" (Cegah Malnutrisi dengan Aksi Sehat / Preventing Malnutrition with Healthy Action) nutrition education delivered through a facilitated PowerPoint presentation versus a printed leaflet on maternal knowledge and self-reported parenting practices. In a two-group pretest posttest quasi-experimental study, 60 mothers of stunted children aged 6-59 months were randomly sampled from the eligible register of a primary health centre catchment area in South Balikpapan District and allocated by service schedule to a PowerPoint group ($n = 30$) or a leaflet group ($n = 30$); individual random assignment was not performed. Each group received a single 30-60 minute CEMAS session. Within-group change was tested with paired t-tests and between-group difference in change with independent-samples t-tests, with an analysis of covariance adjusting for baseline score as a supporting analysis. Knowledge and parenting-practice scores rose in both groups (all $p < 0.001$). The mean pre-to-post change was larger in the PowerPoint group for knowledge (8.30 versus 5.00 points) and for parenting practice (12.43 versus 4.30 points). Post-intervention scores also favoured PowerPoint for knowledge (mean difference 5.13; 95% CI 3.94 to 6.32; $p < 0.001$; Cohen's $d = 2.23$) and for parenting practice (mean difference 5.83; 95% CI 4.70 to 6.96; $p < 0.001$; Cohen's $d = 2.67$). Baseline scores differed between groups, so these estimates are not adjusted for the starting point unless stated. CEMAS-based nutrition education improved maternal knowledge and self-reported parenting practices under both delivery formats, with larger gains under the PowerPoint format. Because allocation was not random, follow-up was short and no anthropometric outcome was measured, any effect on child linear growth remains unestablished and requires confirmation in controlled studies.

Key Messages:

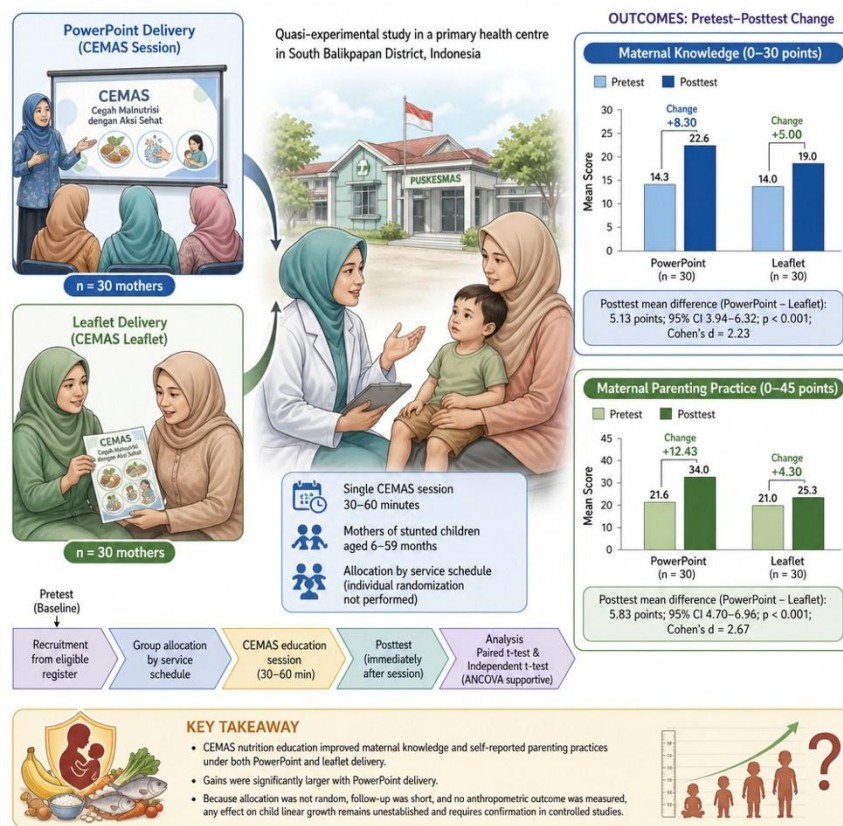
- CEMAS-based nutrition education improved maternal knowledge and self-reported parenting practices; its effect on child linear growth remains to be established.
- The choice of delivery medium mattered: a facilitated PowerPoint session produced larger score gains than a printed leaflet delivered in the same setting by the same personnel.

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GRAPHICAL ABSTRACT



INTRODUCTION

Stunting continues to affect children in both high- and low-income settings and remains a persistent problem in Indonesia (1). It is defined as growth failure in children under five arising from chronic undernutrition, in which height-for-age falls below that of the reference population (2). The World Health Organization (WHO) classifies a child as stunted when height-for-age is below 2 standard deviations (SD) of the WHO Child Growth Standards, and as severely stunted below 3 SD (3).

An estimated 144 million children under five were stunted worldwide in 2020, with more than half of these children living in developing countries (4). Indonesia ranks among the countries carrying the largest absolute burden (5). National survey data show a downward trend in stunting prevalence among children under five, from 27.7% in 2019 to 24.4% in 2021 and 21.6% in 2022 (6,7). The 2023 Indonesian Health Survey recorded a national prevalence of 21.5%, with 23.9% in East Kalimantan Province and 21.6% in Balikpapan City (8). Within Balikpapan, South Balikpapan District recorded a prevalence of 10.55% in 2023. As of December 2024, the catchment area of the primary health centre where this study was conducted recorded 71 stunted children, a prevalence of 9.01% and the second-highest case count in the district (9).

The consequences of stunting extend well beyond height. In the short term, the underlying nutritional deficits increase morbidity and mortality, disturb child development and add to treatment costs. Over the longer term, stunting has been linked to reduced cognitive performance, impaired reproductive health, a higher risk of non-communicable disease, and lower physical capacity and work productivity in adulthood (2,10–12). Biologically and socially, stunting reflects chronic growth failure driven by inadequate nutrient intake, repeated infection and suboptimal caregiving. The Lancet nutrition series has argued that essential nutrition interventions during the first 1,000 days of life protection of breastfeeding, adequate complementary feeding, micronutrient supplementation, and prevention and management of infection can reduce stunting when they are delivered together and at scale (13,14). The 2023 WHO complementary feeding guideline points in the same direction, identifying timing, frequency, dietary diversity, energy

density and responsive feeding for children aged 6–23 months as central to improving growth (15).

Evidence for nutrition education based on social and behaviour change communication (SBCC) has strengthened over the past decade. A systematic review found that maternal nutrition education is associated with improved feeding practices and child nutritional status (16). A cluster randomised trial in a low-income setting reported that community-level behaviour change communication on complementary feeding improved feeding practices and growth indicators (17), and a recent meta-analysis has highlighted the contribution of maternal education to child growth in the first two years of life (18).

What remains less clear is which delivery medium makes such education most effective in a resource-constrained Indonesian primary care setting. Community health centres (Puskesmas) and integrated health posts (Posyandu) typically choose between printed materials, which are cheap and can be taken home, and facilitated presentations, which require equipment and staff time. Local programme guidance offers little empirical basis for that choice. The "CEMAS" programme (Cegah Malnutrisi dengan Aksi Sehat / Preventing Malnutrition with Healthy Action) is a structured SBCC-based education package combining nutrition counselling, participatory discussion and educational media, and it can be delivered in either format without changing its content.

This study therefore compared the effect of CEMAS nutrition education delivered by PowerPoint presentation versus printed leaflet on the knowledge and self-reported parenting practices of mothers of stunted children in a primary health centre catchment area in South Balikpapan District.

METHODS

Study design and setting

This was a quantitative, two-group pretest posttest quasi-experimental study conducted between November 2024 and August 2025 in the catchment area of a primary health centre in South Balikpapan District, Balikpapan City, Indonesia. Reporting follows the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement.

Participants and allocation

The study population comprised mothers of stunted children living in the catchment area. Eligible mothers were identified from the health centre nutrition register and selected by simple random sampling. Selected participants were then allocated to the PowerPoint group (Group A) or the leaflet group (Group B) according to the service schedule under which they attended; individual random assignment was not carried out, which is why the design is classified as quasi-experimental. Inclusion criteria were: mothers of a stunted child aged 6–59 months, defined by a height-for-age Z-score below 2 SD of the WHO Child Growth Standards; permanent residence in the study area; and willingness to participate with written informed consent. Mothers were excluded if they could not attend the full intervention session, if the mother or child had a severe illness that would interfere with participation, or if pretest or posttest data were incomplete.

Intervention

The CEMAS package covers stunting prevention, balanced nutrition, appropriate complementary feeding, growth monitoring, hygiene and responsive parenting. Both groups received identical content from the same trained nutrition personnel in a single session of 30–60 minutes; the two arms differed only in the delivery medium. Group A received a facilitated PowerPoint presentation projected in the health centre; Group B received a printed leaflet with the same content, explained by the facilitator and taken home afterwards. Both arms were delivered face to face, so the comparison is between a projected slide presentation and a printed leaflet rather than between remote digital and print delivery.

Statistical analysis

Data were analysed with [software, version]. Normality was assessed with the Shapiro Wilk test. Within-group pre-to-post change was tested with paired t-tests. Mean differences are presented with 95% confidence intervals, and Cohen's *d* is reported as a standardised effect size. A two-sided $p < 0.05$ was considered statistically significant.

This research was conducted in accordance with the Declaration of Helsinki. The study protocol was reviewed and approved by the Health Research Ethics Committee of Poltekkes Kemenkes Kalimantan Timur, Indonesia. Informed consent was obtained from all respondents prior to data collection.

RESULTS

All 60 enrolled mothers completed the pretest, the intervention session and the posttest; there were no dropouts. Respondent characteristics are shown in Table 1. Most mothers were aged 20–35 years (63.3% in the leaflet group and 70.0% in the PowerPoint group), had completed senior high school (53.3% and 60.0%) and were housewives (83.3% and 80.0%). The groups differed in parity: multiparous mothers predominated in the leaflet group (76.7%) whereas grandmultiparous mothers predominated in the PowerPoint group (56.7%). Age, education and occupation were otherwise comparable.

Descriptive statistics before and after the intervention are presented in Table 2. In the leaflet group the mean knowledge score was 4.70 1.368 at baseline and 9.70 2.261 after the intervention, and the mean parenting-practice score was 7.37 2.566 and 11.67 2.525 respectively. In the PowerPoint group the mean knowledge score was 6.53 2.285 at baseline and 14.83 2.335 afterwards, and the mean parenting-practice score was 5.07 2.016 and 17.50 1.776 respectively. Baseline scores were not balanced: knowledge was higher in the PowerPoint group, whereas parenting practice was higher in the leaflet group.

Table 1. Characteristics of respondents by group

Characteristic	Category	Leaflet (n = 30)		PowerPoint (n = 30)	
		n	%	n	%
Age	20–35 years	19	63.3	21	70.0
	> 35 years	11	36.7	9	30.0
Education	Primary school	6	20.0	6	20.0
	Junior high school	8	26.7	6	20.0
	Senior high school	16	53.3	18	60.0
Occupation	Housewife	25	83.3	24	80.0
	Employee	3	10.0	3	10.0
	Entrepreneur	2	6.7	3	10.0
Parity ^a	Multipara	23	76.7	13	43.3
	Grandmultipara	7	23.3	17	56.7
Total		30	100	30	100

Table 2. Mean, standard deviation and range of knowledge and parenting-practice scores before and after the intervention

Group and indicator	Mean	SD	Range (min–max)
PowerPoint (n = 30)			
Knowledge, baseline	6.53	2.285	2–11
Knowledge, post-intervention	14.83	2.335	10–17
Parenting practice, baseline	5.07	2.016	2–9
Parenting practice, post-intervention	17.50	1.776	13–20
Leaflet (n = 30)			
Knowledge, baseline	4.70	1.368	2–5
Knowledge, post-intervention	9.70	2.261	6–15
Parenting practice, baseline	7.37	2.566	3–15
Parenting practice, post-intervention	11.67	2.525	7–17

Between-group comparisons are shown in Table 4. In the unadjusted comparison of post-intervention scores, the mean difference was 5.13 points for knowledge (95% CI 3.94 to 6.32; $p < 0.001$; Cohen's $d = 2.23$) and 5.83 points for parenting practice (95% CI 4.70 to 6.96; $p < 0.001$; Cohen's $d = 2.67$). Because baseline scores were unbalanced, the baseline-adjusted analysis of covariance reported in the Methods should be read as the primary estimate of the between-group difference.

Table 3. Within-group change in knowledge and parenting-practice scores after CEMAS education

Group and indicator	Baseline, mean $\pm$ SD	Post-intervention, mean $\pm$ SD	p ^c
PowerPoint (n = 30)			
Knowledge	6.53 $\pm$ 2.285	14.83 $\pm$ 2.335	< 0.001
Parenting practice	5.07 $\pm$ 2.016	17.50 $\pm$ 1.776	< 0.001
Leaflet (n = 30)			
Knowledge	4.70 $\pm$ 1.368	9.70 $\pm$ 2.261	< 0.001
Parenting practice	7.37 $\pm$ 2.566	11.67 $\pm$ 2.525	< 0.001

Table 4. Between-group comparison of knowledge and parenting-practice scores

Outcome	Leaflet (n = 30)	PowerPoint (n = 30)	Mean difference (95% CI)	p / Cohen's d
Panel B. Post-intervention scores (supporting comparison)				
Knowledge	9.70	14.83	5.13 (3.94 to 6.32)	< 0.001 / 2.23
Parenting practice	11.67	17.50	5.83 (4.70 to 6.96)	< 0.001 / 2.67

DISCUSSION

Maternal knowledge and self-reported parenting practices improved in both arms after the CEMAS session, and the improvement was larger when the content was delivered as a facilitated slide presentation than as a printed leaflet. The pattern was consistent across both outcomes and both analytic approaches. At baseline, mothers' understanding of stunting was largely limited to the idea of being short, and few could distinguish short stature from chronic growth failure. Awareness of causes, health consequences and prevention was also limited. This is consistent with earlier work reporting an association between maternal knowledge and stunting, in which children of mothers with lower knowledge scores were more often stunted (19).

Baseline caregiving and feeding practices showed similar gaps. Mothers reported not giving colostrum, introducing foods or fluids other than breastmilk before six months, irregular feeding schedules and a monotonous diet. Feeding environments received little attention, and mothers had few strategies for a child with poor appetite. Hygiene practices such as toothbrushing and nail care were often neglected, and use of preventive services routine growth monitoring at the Posyandu, completion of immunisation, and nutrition counselling was low. After the session, respondents described more appropriate feeding practices, including exclusive breastfeeding, age-appropriate complementary feeding and greater dietary diversity, together with more attention to child hygiene and a stated intention to use preventive services more regularly. These are self-reported changes measured shortly after the intervention and should not be equated with sustained behaviour change.

The improvement observed in the leaflet arm is in line with previous Indonesian studies. Nutrition education delivered by leaflet has been reported to improve maternal knowledge and children's protein, zinc and calcium intake (20), and leaflet-based counselling increased stunting-related knowledge among pregnant women (21). A further study reported a rise in maternal knowledge after leaflet-based health education (22). A systematic review likewise concluded that maternal nutrition education improves maternal knowledge and attitudes and is associated with better child nutritional status (16). Leaflets are portable, inexpensive and can be revisited at home, which makes them well suited to Posyandu sessions and health centre campaigns.

The larger gains in the PowerPoint arm are also consistent with the wider literature. Leaflets remain a passive medium: the information is available, but engagement depends heavily on the mother's own initiative (23). A facilitated presentation combines text, images and spoken narration in a single sequence, which holds attention and supports recall. Comparable improvements in maternal knowledge have been reported for other multimedia formats, including digital pocket books and animated video (24). The Cognitive Theory of Multimedia Learning offers a plausible mechanism: information presented through complementary visual and verbal channels is easier to process and retain than the same information presented in one channel alone. On this reading, the leaflet functions best as a reinforcement

tool that reminds mothers of content already delivered, rather than as a standalone medium. Both arms in this study were delivered face to face by the same trained personnel. The difference between the arms therefore reflects the presentation format and the accompanying facilitation, not a contrast between remote digital and print delivery. Part of the observed advantage may be attributable to the facilitator's live explanation rather than to the slides themselves, and the present design cannot separate the two.

At the programme level, the findings suggest that health centres with access to a projector and staff time may obtain larger short-term gains from facilitated presentations than from leaflets alone, while retaining leaflets as take-home reinforcement. Nutrition-sensitive and nutrition-specific interventions have been argued to work best when delivered in combination (25), and a hybrid approach is consistent with that view. Any effect on child linear growth, however, cannot be inferred from the present data, since no anthropometric outcome was measured.

Limitations

Several limitations should be considered when interpreting these results. Allocation was determined by service schedule rather than by randomisation, so unmeasured differences between the groups cannot be excluded; the groups also differed at baseline in parity and in both outcome scores, and the unadjusted between-group estimates are correspondingly vulnerable to regression to the mean. Parenting practice was self-reported and measured shortly after an educational session, which makes social-desirability bias likely. The study was conducted in a single health centre catchment area with 60 participants, which limits generalisability and precision. Follow-up was short, so persistence of the observed gains is unknown. No anthropometric outcome was collected, so no conclusion can be drawn about the effect of the intervention on stunting itself. Finally, the facilitator was not blinded and the same personnel delivered both arms, which may have introduced performance bias.

Contribution of the study

To our knowledge this is the first evaluation of the CEMAS package in this catchment area, and one of few Indonesian studies to compare two delivery media for the same nutrition education content while assessing both knowledge and reported caregiving practice, including complementary feeding, hygiene and use of health services. The results are intended to inform local media selection rather than to establish the efficacy of the package on growth outcomes.

CONCLUSION

CEMAS-based nutrition education improved maternal knowledge and self-reported parenting practices in both delivery formats, and the improvement was larger when the content was delivered as a facilitated PowerPoint presentation than as a printed leaflet. Given the non-random allocation, the baseline imbalance and the short follow-up, these findings are best treated as preliminary support for using facilitated visual media in routine nutrition counselling, with leaflets retained as take-home reinforcement. Controlled studies with baseline-adjusted analysis, longer follow-up and anthropometric endpoints are needed before the package is recommended for wider scale-up.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Abri N, Sirajuddin S, Bahar B, Jafar N, Russeng SS, Zakaria Z, et al. Determinants of incident stunting in elementary school children in endemic area iodine deficiency disorders Enrekang Regency. *Open Access Maced J Med Sci*. 2022;10:161 7.
2. Dewi NK, Kusumasari HAR, Andarini S, Indrawan IWA. Nutritional factors affecting stunting among toddlers. *Amerta Nutr*. 2023;7(1SP):25 9.
3. Abri N, Zakiah N, Risal AF. The relationship between early pregnancy, birth distance, and resident status with stunting incidence in elementary school children in Enrekang rural. *J Health Nutr Res*. 2023;2(2):70 8.
4. UNICEF, WHO, World Bank Group. Levels and trends in child malnutrition: joint child malnutrition estimates. Geneva: World Health Organization; 2020. Available from: <https://www.who.int/publications/i/item/9789240003576>
5. Pangestuti M, Khomsan A, Ekayanti I. Determinants of stunting in children aged 6 24 months in rural areas: case control study. *AcTion Aceh Nutr J*. 2023;8(3):318.
6. [ementerian Kesehatan RI. Laporan Studi Status Gizi Indonesia (SSGI) 2021. Jakarta: Badan Kebijakan Pembangunan Kesehatan; 2021.
7. Kementerian Kesehatan RI. Buku saku hasil Survei Status Gizi Indonesia (SSGI) 2022. Jakarta: Badan Kebijakan Pembangunan Kesehatan; 2022. p. 1 156.
8. Kementerian Kesehatan RI. Survei Kesehatan Indonesia (SKI) 2023: dalam angka. Jakarta: Badan Kebijakan Pembangunan Kesehatan; 2023.
9. Primary health centre routine nutrition surveillance records, South Balikpapan District, December 2024. Unpublished local programme data.
10. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet*. 2013;382(9890):427 51.
11. Beal T, Tumilowicz A, Sutrisna A, Izwardy D, Neufeld LM. A review of child stunting determinants in Indonesia. *Matern Child Nutr*. 2018;14(4):1 10.
12. Jihad FF, Sriwahyuni S, Darmawan D, Murdani I. Literature review: factors associated with malnutrition in children younger than five. *J Nutr Sci*. 2022;3(2):51 9.
13. Shekar M, Condo J, Pate MA, Nishtar S. Maternal and child undernutrition: progress hinges on supporting women and more implementation research. *Lancet*. 2021;397(10282):1329 31. Available from: [http://dx.doi.org/10.1016/S0140-6736\(21\)00577-8](http://dx.doi.org/10.1016/S0140-6736(21)00577-8)
14. Heidkamp RA, Piwoz E, Gillespie S, Keats EC, D'Alimonte MR, Menon P, et al. Mobilising evidence, data, and resources to achieve global maternal and child undernutrition targets and the Sustainable Development Goals: an agenda for action. *Lancet*. 2021;397(10282):1400 18.
15. World Health Organization. WHO guideline for complementary feeding of infants and young children 6 23 months of age. Geneva: World Health Organization; 2023. 76 p. Available from: [insert the correct WHO URL the DOI in the previous version belonged to an unrelated journal]
16. Prasetyo YB, Permatasari P, Susanti HD. The effect of mothers' nutritional education and knowledge on children's nutritional status: a systematic review. *Int J Child Care Educ Policy*. 2023;17(1). Available from: <https://doi.org/10.1186/s40723-023-00114-7>
17. Gebretsadik MT, Tamiru D, Sisay AL, Belachew T. Effect of behavioural change communication through women development army on optimal complementary feeding practice among children aged 6 23 months in Southwest Ethiopia: a cluster randomized controlled trial. *Nutr J*. 2025;24(1).
18. Rezaeizadeh G, Mansournia MA, Keshtkar A, Farahani Z, Zarepour F, Sharafkhah M, et al. Maternal education and its influence on child growth and nutritional status during the first two years of life: a systematic review and meta-analysis. *eClinicalMedicine*. 2024;71:102574. Available from: <https://doi.org/10.1016/j.eclinm.2024.102574>
19. Abri N. Identification of socio-demographic factors with the incidence of stunting in elementary school children in rural Enrekang. *J Health Nutr Res*. 2022;1(2):88 94.
20. Setiadi Y, Imawati Q, Noviardhi A, Supadi J, Subandriani DN, Widiyanto SD. The effect of nutritional

- education with leaflet media on increasing maternal knowledge and intake of protein, zinc, calcium in stunting children aged 6 23 months. *Int J Med Sci Clin Res Stud*. 2023;3(10):2318 23.
21. Munthe J. The effect of leaflet media counseling to increase stunting knowledge on pregnant women. *Sci Midwifery*. 2021;9(2):595 9.
 22. Achjar KAH, Marni NK, Lestari AS, Ribek IN. Health education with leaflet media on the level of knowledge of mothers about toddler rearing partners in stunting prevention. *J Educ Res Eval*. 2023;7(2):197 203.
 23. Herlinadiyaningsih H, Arisani G. Efektivitas media video dan leaflet terhadap tingkat pengetahuan dan sikap tentang menstrual hygiene di MA Darul Ulum Palangka Raya. *J Surya Med*. 2022;8(2):193 207.
 24. Carin V, Juwandhi AR, Anwar K, Setyowati A, Fitri YP. Pengaruh edukasi pencegahan stunting dengan media buku saku digital dan video animasi terhadap tingkat pengetahuan dan sikap ibu balita di Posyandu Merah Delima, Kota Tangerang. *J Abdi Masy Indones*. 2024;4(1):163 70.
 25. Ruel MT, Alderman H. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet*. 2013;382(9891):536 51. Available from: [http://dx.doi.org/10.1016/S0140-6736\(13\)60843-0](http://dx.doi.org/10.1016/S0140-6736(13)60843-0)