

ICERNAS (Intelligent Mother for a Health Child) a smart education model to enhance pregnant women's knowledge in preventing stunting

Syastriani Isna Putri Syarif¹, Wa Ode Nesya Jeni Samrida

Study Program of Diploma Three Midwifery, Department of Health, Politeknik Baubau, Baubau, Indonesia

Abstract. Stunting remains a major public health concern that affects children's physical and cognitive development, particularly in Indonesia where the prevalence is still high. In South Buton Regency, Southeast Sulawesi, stunting increased 1.38% from 2024 to mid-2025, highlighting the need for effective preventive interventions. This study aimed to evaluate the effectiveness of the ICERNAS (Intelligent Mother for a Healthy Child) model in improving maternal knowledge on parenting practices and balanced nutrition as efforts to prevent stunting. A quasi-experimental design using a Two-Group Pretest-Posttest approach was applied. Forty pregnant women were selected through stratified random sampling and assigned equally to intervention and control groups. Data were collected using validated questionnaires measuring parenting and nutrition knowledge. Statistical analysis used paired sample t-tests and independent t-tests. Results showed significant improvements in the intervention group, where parenting knowledge increased from 61.80 to 77.20 ($p = 0.001$) and nutrition knowledge from 60.40 to 78.90 ($p = 0.001$). The control group demonstrated minimal, non-significant changes. Between-group comparisons confirmed meaningful differences in knowledge gains. These findings indicate that ICERNAS, which integrates structured education on parenting and nutrition, is effective in strengthening maternal knowledge and offers a promising strategy to reduce stunting, particularly in high-risk coastal areas

1 Introduction

Stunting is a chronic nutritional problem that has long-term impacts on the quality of human resources[1], including reduced cognitive abilities, productivity, and an increased risk of non-communicable diseases in adulthood as a result of chronic malnutrition, which causes children to be too short for their age. According to the World Health Organization (WHO), the global prevalence of stunting in 2022 was 22.3%. Although this figure has gradually declined over the years, it remains relatively high. Several studies indicate that the

¹Corresponding author: isnaputri01@gmail.com

implementation of balanced nutrition during pregnancy and the fulfillment of nutritional intake, particularly during the First 1,000 Days of Life, are crucial factors influencing the occurrence of stunting among children[2]. In addition, maternal health status also plays an important role in determining the nutritional and health status of children [3].

Based on the 2023 Indonesia Health Survey (SKI), the prevalence of stunting decreased slightly from 21.6% to 21.5%, continuing a downward trend over the past ten years (2013–2023) [4]. However, this figure is still far from the National Medium-Term Development Plan (RPJMN) target for 2020–2024, which is set at 14%. Similarly, in Southeast Sulawesi Province, the prevalence of stunting in 2024 reached 11.33%, an increase of 2% compared to the previous year. Stunting also remains a concern in coastal areas of Southeast Sulawesi, such as South Buton Regency. Data from the South Buton TPPS showed that the prevalence was 33.6% in 2022, slightly decreased to 33% in 2023, and then dropped to 22.8% in 2024. However, these numbers still indicate that significant progress has not yet been achieved. During a convergence coordination meeting on accelerating stunting reduction, the Head of BKKBN South Buton stated that stunting is not only related to children's and maternal nutrition during pregnancy, but also strongly influenced by parenting practices. This is consistent with research findings showing a significant relationship between parenting styles and stunting, where authoritarian and permissive parenting tend to be associated with higher stunting rates compared to democratic parenting, with a reported p-value of 0.003 and $r = 0.576$ [5]

Despite various efforts by both central and local governments, the prevalence of stunting in South Buton Regency actually increased from 22.8% in 2024 to 24.18% in the second quarter of 2025. This suggests that current approaches have not been fully effective and that more targeted and intensive strategies are required. Based on this, the researchers developed the ICERNAS (Intelligent Mother for a Healthy Child) intervention model, which integrates nutrition education and parenting practices. This model is designed to improve pregnant women's knowledge of the importance of balanced nutrition and appropriate parenting practices to optimally support children's growth and development [6]. The inclusion of a psycho-emotional approach in ICERNAS aims to enhance mothers' potential and self-confidence in providing appropriate parenting, while balanced nutrition education increases their accuracy in ensuring proper nutrient intake for their children during the first 1,000 days of life, delivered interactively and applicatively.

This research is important to fill the gap in existing intervention models, which are often general and lack contextual adaptation. Furthermore, the findings are expected to serve as a reference for policies and community-based intervention programs that are more effective in reducing stunting prevalence, particularly in coastal and disadvantaged areas. Based on the above, the research problem can be formulated as follows: "To what extent is the effectiveness of the ICERNAS (Intelligent Mother for a Healthy Child) intervention in improving knowledge about parenting practices and balanced nutrition as an effort to prevent stunting in the coastal areas of South Buton Regency, particularly in Batauga District?"

The problem-solving approach and strategy in this study employed Paired Sample t-Test and Independent Sample t-Test analyses. The t-test is an inferential statistical method used to determine mean differences between groups [7]. Previous studies have also shown that the quasi-experimental method with a Two-Group Pretest-Posttest design and t-test analysis is effective in measuring the impact of educational interventions on health behaviors, particularly among pregnant and breastfeeding mothers [8]. Therefore, this approach is considered appropriate to address the research objectives and produce measurable outcomes. In this study, the Paired Sample t-Test was used to examine the effectiveness of the ICERNAS intervention in improving knowledge of parenting practices and balanced nutrition within each group (control and intervention) before and after the intervention. Meanwhile, the Independent Sample t-Test was applied to compare differences in changes

between the two groups, in order to determine whether ICERNAS was significantly more effective than usual practices or no intervention. The results of the t-test analysis not only provide insights into the effectiveness of the intervention but also reinforce empirical evidence that structured educational approaches such as ICERNAS can serve as an evidence-based solution in efforts to reduce stunting.

The results of this study hold significant potential for strengthening community-based nutritional improvement and risk prevention efforts, particularly in accelerating the reduction of stunting. Previous studies have largely focused on identifying causal factors through approaches such as the use of leaflets, educational videos, and nutrition counseling, as well as the application of logistic regression analysis to determine stunting risk factors [9]. However, these approaches have not addressed structured educational interventions developed in an applicative and behavior-based manner.

The ICERNAS (Intelligent Mother for a Healthy Child) model was developed as an integrated intervention that combines balanced nutrition education with the strengthening of parenting practices through a psycho-emotional approach. Unlike previous intervention models that generally focus only on delivering knowledge through single media formats such as leaflets, educational videos, or conventional counseling, ICERNAS is designed to be applicative, interactive, and behavior-oriented. The main advantage of ICERNAS lies in its simultaneous integration of improved nutritional literacy, strengthened parenting capacity, and enhanced maternal self-confidence, making the intervention more comprehensive and contextual. In addition, the model is specifically tailored for pregnant women in coastal areas who have unique social, cultural, and healthcare access challenges, providing added value compared to general models that do not adequately consider local context.

Based on the description above, this study aims to analyze the effectiveness of the ICERNAS (Intelligent Mother for a Healthy Child) intervention model in improving maternal knowledge of parenting practices and balanced nutrition as preventive measures against stunting

2 Methods

This study employed a quasi-experimental design with a two-group pretest-posttest approach, involving more than one group (intervention and control groups) to assess the effectiveness of the ICERNAS intervention in improving knowledge of parenting practices and balanced nutrition as a strategy to prevent stunting in the coastal area of Batauga District, South Buton Regency. The intervention group was selected from the working area of Batauga Community Health Center, while the control group was drawn from the working area of Sampolawa Community Health Center. The study population consisted of all pregnant women residing in the working areas of the Batauga and Sampolawa health centers. The sample in this study met the following inclusion criteria: (1) pregnant women in their second trimester, (2) pregnant women without serious health complications during pregnancy, and (3) mothers residing in the study location. The exclusion criteria were pregnant women with preterm indications and those with comorbid conditions during the data collection period. Sample size calculation was conducted using the two-proportion hypothesis test based on the formula provided in Table 6d of the *Sample Size for Sample Test of Proportions* reference book, applying a one-sided approach with a 95% confidence level, 5% significance level, and 90% statistical power.

Based on the sample size calculation, a minimum of 36 respondents was required. To anticipate potential dropouts, an additional 10% was added to the minimum sample size, resulting in a total of 40 pregnant women needed for both the intervention and control groups. To ensure representation of the population's characteristics, the sampling technique

employed was stratified random sampling, in which the population was divided into several non-overlapping groups (strata), and random samples were then drawn from each stratum.

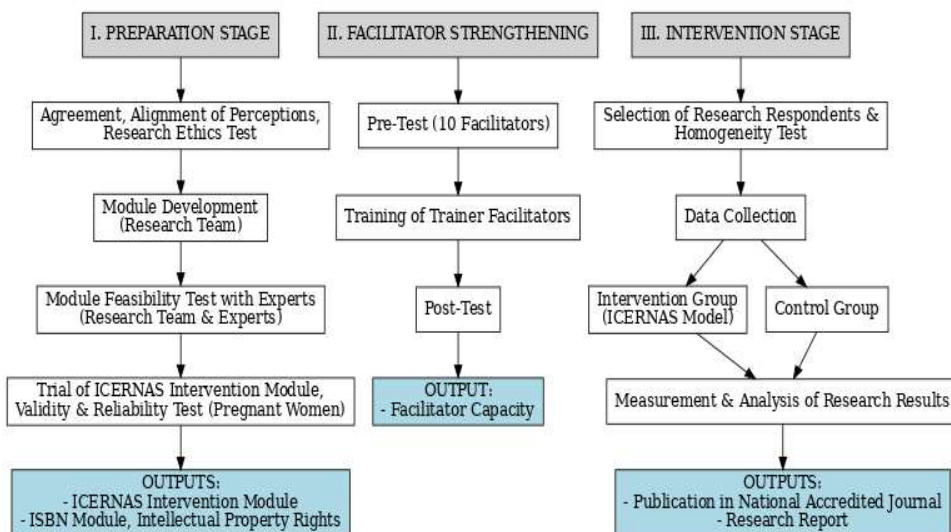


Fig.1. Research stages

3 Results and discussion

3.1 Result

The validity test was conducted on the research instruments, consisting of the parenting knowledge questionnaire and the balanced nutrition knowledge instrument, involving 30 pregnant women as pilot respondents. The analysis used Pearson’s Product Moment correlation, where an item was considered valid if the calculated r-value was greater than the r-table value (0.361) at a 5% significance level. Based on the results shown in Tables 7 and 8, all questionnaire items had r-values greater than the r-table. This indicates that each item was able to measure the intended construct. Therefore, all items were declared valid and suitable for use in the main study.

Table 1. Reliability test results

Instrument	Cronbach’s Alpha	Remark
Parenting Knowledge	0.872	Reliable
Balanced Nutrition Knowledge	0.884	Reliable

The reliability test was carried out using Cronbach’s Alpha. An instrument is considered reliable if the Cronbach’s Alpha value is greater than 0.70. The results in Table 1 show that the parenting knowledge questionnaire had a Cronbach’s Alpha value of 0.872, while the balanced nutrition knowledge instrument scored 0.884. Both values exceeded 0.70, indicating that the instruments demonstrated a very good level of internal consistency.

Table 2. Results of Paired Sample t-Test (Pre–Post within Groups, n = 40)

No	Variable	Group	Mean Pre	Mean Post	Difference	p-value
1	Parenting	Intervention	61.80	77.20	15.40	0.001
	Knowledge	Control	61.50	63.10	1.60	0.210
2	Balanced Nutrition	Intervention	60.40	78.90	18.50	0.001
	Knowledge	Control	59.70	61.00	1.30	0.180

Based on the table 2, the intervention group (20 respondents), there was a statistically significant increase in parenting knowledge scores (61.80 → 77.20) and balanced nutrition knowledge scores (60.40 → 78.90) (p = 0.001). In the control group (20 respondents), scores increased only slightly in both parenting (61.50 → 63.10) and balanced nutrition (59.70 → 61.00), but the changes were not statistically significant (p > 0.05).

Table 3. Results of Independent Sample t-Test (Between Groups, n = 40)

No	Variable	Mean Intervention	Mean Control	p-value
1	Parenting knowledge	15.40	1.60	0.002
2	Balanced nutrition knowledge	18.50	1.30	0.001

Based on the table 3, The difference in mean score improvements (Δ mean) between the intervention and control groups was substantial: Parenting knowledge: 15.40 vs 1.60 (p = 0.002). Balanced nutrition knowledge: 18.50 vs 1.30 (p = 0.001). These results indicate that the increase in knowledge among the intervention group was significantly greater compared to the control group

3.2 Discussion

3.2.1 Parenting knowledge variable

The results of the study showed a significant increase in parenting knowledge in the intervention group, from an average of 61.80 to 77.20 (p = 0.001). In contrast, the control group experienced only a slight increase from 61.50 to 63.10, which was not statistically significant (p = 0.210). This indicates that structured educational interventions are effective in improving pregnant women’s understanding of appropriate parenting compared to no intervention.

This finding is consistent with the study by [10], which reported that health education interventions using booklet media were effective in enhancing parenting knowledge among mothers of toddlers. The significant increase observed in the intervention group compared to the control group suggests that educational media have a positive impact on the process of information transfer. This similarity emphasizes the importance of educational methods in optimizing maternal knowledge. However, a difference can be noted when compared with the study by [11], which reported that maternal knowledge did not increase significantly after being given brief counseling without supporting media. This discrepancy can be explained by the fact that the success of education is not solely determined by the content of the material but also by the methods and media used. In the present study, the intervention was delivered through an integrated approach, making it more effective.

A positive correlation between increased maternal knowledge and the role of mothers in childcare has also been confirmed by [12], who stated that the higher a mother’s understanding of parenting, the better the child’s developmental stimulation provided. Thus, the results of this study carry important implications for midwifery practice, particularly in

education programs during the First 1,000 Days of Life. Overall, these findings strengthen the evidence that structured educational interventions have a significant impact on improving parenting knowledge. When compared with previous studies, the results are consistent with the majority of research emphasizing the effectiveness of group-based education. Nevertheless, this study also highlights that the effectiveness of interventions largely depends on the methods and media employed.

3.2.2 *Balanced nutrition knowledge variable*

For the balanced nutrition knowledge variable, the results showed a significant increase in the intervention group, from an average score of 60.40 to 78.90 ($p = 0.001$). Meanwhile, the control group experienced only a small increase from 59.70 to 61.00, which was not statistically significant ($p = 0.180$). These findings indicate that the educational intervention provided was effective in improving pregnant women's understanding of balanced nutrition principles, which are crucial during pregnancy. This result is consistent with the study by [13], which found that nutrition interventions using audiovisual media significantly improved nutrition knowledge among pregnant women. This similarity reinforces the notion that interactive educational methods are more effective than conventional counseling. Thus, this study adds empirical evidence that balanced nutrition knowledge can be significantly improved through educational interventions.

However, these findings differ from those of [5], who reported that improvements in nutrition knowledge among pregnant women occurred only in specific aspects, such as iron requirements, and not in the overall principles of balanced nutrition. This difference is likely due to variations in the duration of intervention and the scope of the material provided. In this study, the material delivered was comprehensive, resulting in more holistic improvements in knowledge. It is important to note that improvements in balanced nutrition knowledge among pregnant women have a direct impact on both maternal and fetal nutritional status. This is consistent with the findings of [14], who reported a positive relationship between maternal nutrition knowledge and the incidence of anemia. In other words, the higher the mother's level of understanding, the lower the risk of nutritional problems during pregnancy.

Therefore, this study emphasizes that balanced nutrition education for pregnant women is crucial in supporting the success of maternal and child health programs. Compared with other studies, the results generally support the conclusion that education is an effective strategy for improving nutrition knowledge. However, this study provides an advantage in its integration of materials, thereby producing broader impacts on respondents' understanding. [10] also demonstrated that parenting education using booklet media effectively improved mothers' understanding of appropriate childcare, helping to protect children from growth and developmental delays. In addition, balanced nutrition education plays a vital role in stunting prevention. According to the Balanced Nutrition Guidelines from the [15], fulfilling age-appropriate macro- and micronutrient requirements supports optimal child growth, particularly in preventing chronic energy deficiency, which is a major cause of stunting. [13] also showed that audiovisual-based nutrition interventions successfully improved pregnant women's nutritional knowledge, which in turn positively affected both maternal and fetal nutritional status.

3.2.3 *The role of the ICERNAS intervention*

The ICERNAS (Intelligent Mother for a Healthy Child) intervention serves as an innovative model that integrates parenting education and balanced nutrition. This intervention helps transform pregnant women's knowledge into a more comprehensive understanding of their

role in preventing stunting. Through a structured educational method, ICERNAS encourages a shift in mothers' perspectives from initially paying little attention to parenting and nutritional intake, to becoming more aware and deliberate in making decisions related to child health

Furthermore, ICERNAS plays an important role in guiding pregnant women's practical actions, such as choosing nutritious foods, paying attention to child developmental stimulation, and applying positive parenting practices within the family. This aligns with Nola J. Pender's concept of health promotion, which emphasizes the importance of health education in encouraging healthy lifestyle behaviors. Thus, the ICERNAS intervention not only enhances knowledge but also fosters sustainable behavioral changes to prevent stunting in children.

3.2.4 *Limitation of study*

The main limitation of this study is that the measurements conducted focused only on the short-term effects of the educational intervention provided. The research did not include follow-up assessments to determine whether the improvement in knowledge regarding parenting practices and balanced nutrition could be sustained over a longer period or effectively applied in the daily lives of pregnant women. In fact, the continuity of behavioral change is a crucial aspect in stunting prevention efforts. Without long-term monitoring, it is difficult to ensure whether the education delivered generates a lasting impact on parenting behavior, food choices, and maternal health practices after the intervention period ends. Therefore, further studies incorporating follow-up designs are needed to evaluate the intervention's effectiveness more comprehensively and to monitor behavioral changes over an extended period.

4 Conclusion

The ICERNAS (Intelligent Mother for a Healthy Child) intervention has proven effective in significantly improving pregnant women's knowledge of both parenting and balanced nutrition. Beyond knowledge gains, ICERNAS fosters behavioral changes by guiding mothers to adopt healthier dietary practices, provide appropriate child stimulation, and implement positive parenting strategies. As an integrated and structured educational model, ICERNAS represents an innovative and sustainable approach to stunting prevention, with strong potential for replication in similar communities.

References

- [1] C. M. McKinney *et al.*, "Growth Patterns Between Ages 0 and 36 Months Among US Children With Orofacial Cleft: A Retrospective Cohort Study," *J. Acad. Nutr. Diet.*, vol. 125, no. 4, pp. 537–544, 2024, doi: 10.1016/j.jand.2024.05.012.
- [2] M. J. Nyarko, W. Ham-baloyi, and D. R. M. Van Rooyen, "Qualitative Exploration of Health Professionals' Perceptions of Addressing Malnutrition Within the First 1,000 Days," *J. Nutr. Educ. Behav.*, vol. 56, no. 7, pp. 442–451, 2025, doi: 10.1016/j.jneb.2024.03.010.
- [3] G. Dessie, J. Li, S. Nghiem, and T. Doan, "Social Science & Medicine Child stunting, thinness, and their academic performance in Ethiopia: A longitudinal study," *Soc. Sci. Med.*, vol. 373, no. April, p. 118050, 2025, doi: 10.1016/j.socscimed.2025.118050.

- [4] “Survei Kesehatan Indonesia (SKI) Dalam Angka.” Kemenkes, Jakarta, 2023.
- [5] T. D. Pratiwi and E. Yerizel, “Hubungan Pola Asuh Ibu dengan Status Gizi Balita di Wilayah Kerja Puskesmas Belimbing Kota Padang,” *J. Kesehat. Andalas*, vol. 5, no. 3, pp. 661–665, 2016, [Online]. Available: <https://jurnal.fk.unand.ac.id/index.php/jka/article/view/595>
- [6] S. I. P. Syarif, Asriadi., and Anita., “Hubungan Perilaku Ibu dalam Pemilihan Makanan Balita Dengan Statu Gizi Kurang di Wilayah Kerja Puskesmas Wajo,” *J. Syntax Admiration*, vol. 4, no. 7, pp. 979–988, 2023, [Online]. Available: <https://www.jurnalsyntaxadmiration.com/index.php/jurnal/article/view/715>
- [7] F. Elba and N. S. Umar, “Mother ’ s knowledge of nutrition and protein intake in stunted children aged 12-36 months in Indonesia,” *Int. J. Innov. Res. Sci. Stud.*, vol. 7, no. 276, pp. 56–62, 2024, doi: 10.53894/ijirss.v7i1.2418.
- [8] F. Faridah, A. Anies, M. I. Kartasurya, and B. Widjanarko, “Online educational intervention: Improving maternal knowledge and attitudes in providing developmental stimulation for stunting toddlers,” *Narra J.*, vol. 4, no. 1, pp. 1–9, 2024, doi: <http://doi.org/10.52225/narra.v4i1.591>
- [9] F. R. Fadmi, S. Mulyani, L. D. Buton, W. Ode, S. Justin, and Y. Riza, “Health Dynamics Logistic Regression Analysis of Risk Factors for Stunting Among Toddlers Aged 24-59 Months in Southeast Sulawesi , Indonesia Health Dynamics,” *Heal. Dyn.*, vol. 2, no. 2, pp. 85–91, 2025, doi: <https://doi.org/10.33846/hd20206>.
- [10] Raodah, S. N. Djannah, and L. Hadayan, “Efektivitas Media Edukasi Booklet terhadap Pengetahuan dan Sikap Ibu Balita Stunting Aceh,” *Indones. J. Heal. Promot.*, vol. 6, no. 5, pp. 931–937, 2023.
- [11] S. Handayani, Y. S. Pratiwi, and N. Fatmawati, “Pengaruh Penyuluhan Kesehatan Terhadap Pengetahuan Ibu Hamil Trimester III Tentang Metode Pembuatan Sayur Bening Daun Katuk Sebagai Upaya Meningkatkan Produksi ASI,” *Prof. Heal. J.*, vol. 5, no. 1, pp. 108–114, 2023.
- [12] N. P. M. Juniantari, K. Y. Triana, N. M. A. Sukmandari, and N. K. Purwaningsih, “Hubungan Pengetahuan Ibu Terhadap Kejadian Stunting Pada Balita Di Wilayah Kerja Puskesmas Abang I,” *J. Keperawatan*, vol. 12, no. 1, 2024.
- [13] D. Elsanti and Sumarmi, “Pengaruh Pemberian Edukasi Video Audiovisual Terhadap Pengetahuan Ibu Hamil Tentang Asupan Gizi di desa sokaraja lor,” *J. Ilm. Keperawatan*, vol. 9, no. 1, pp. 107–112, 2023.
- [14] W. N. Ambarsari and T. Utami, “Hubungan Pengetahuan Tentang Gizi Ibu Hamil Dengan Kejadian Anemia Pada Ibu Hamil,” *CITRA DELIMA J. Ilm. STIKES Citra Delima Bangka Belitung*, vol. 3, no. 1, 2019.
- [15] A. Sari, W. A., Lestari, R., & Widodo, “Efektivitas media booklet terhadap peningkatan pengetahuan pola asuh ibu balita.,” *J. Keperawatan Muhammadiyah Bengkulu*, vol. 6, no. 2, pp. 112–120, 2021, doi: <https://doi.org/10.30651/jkm.v6i2.832>.