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Eggs as a Local Food Innovation and an Integrated Strategy for Stunting Prevention in Indonesia

Nico Syah Putra[1)], Oktarina Oktarina[2)], Anggi Dwi Indriani[3)], Leksa Sahara Pramona[4)], Siska Margareta[5)], Muhammad Chumaidi[6)] , Alhanannasir Alhanannasir[7)]
Email: nico_syahputra@um-palembang.ac.id

Abstract. Stunting remains a challenging chronic nutritional issue in Indonesia due to its significant impact on physical growth, cognitive ability, and the overall quality of human resources. Preventing this condition requires cross-sectoral interventions through innovative, nutrient-dense foods that are accessible to the community. Eggs, as a local source of high-quality animal protein with excellent biological value, hold great potential as a primary ingredient in supplementary foods for children. This study aims to integrate scientific research findings and national policies regarding the contribution of eggs in reducing stunting rates, as well as to assess the effectiveness of egg-based food innovations in child nutrition programs in Indonesia. The study employed a literature review method involving ten national and international articles published between 2018 and 2025. The results showed that consuming one egg per day for six months could increase children's length-for-age z-score (LAZ) by 0.63 SD and reduce stunting prevalence by up to 47%. Local programs such as **SETEL (Sehat dengan Telor)** and combinations of mung bean juice with boiled eggs have been proven to improve children's nutritional status in various regions. The synergy between local food innovations, nutrition education, and cross-sectoral policies serves as an effective strategy to accelerate sustainable stunting reduction.

Keywords: *eggs, stunting, child nutrition, food innovation, nutrition policy*

INTRODUCTION

Stunting is a chronic growth disorder in children caused by nutritional deficiencies occurring during the first 1,000 days of life. Children who experience stunting have a height that is lower than the age-standardized measurement,

indicating long-term linear growth impairment. According to the 2023 Indonesian Nutritional Status Survey (SSGI), the prevalence of stunting in Indonesia remains at 21.6%, far above the national target of 14% set for 2024. This condition not only affects learning ability and economic productivity but also diminishes the overall quality of future generations (sebayang,2023; sebayang,2024)

The causes of stunting are complex, including inadequate nutritional intake, recurrent infections, poor sanitation, and improper childcare practices. Studies by Madhe et al. (2021) and Oktarina & Sudiarti (2013) show that maternal height, education level, and complementary feeding practices (MP-ASI) are significantly associated with stunting incidence. Socioeconomic factors such as poverty, limited access to nutritious foods, and lack of nutritional knowledge further exacerbate the situation. In recent years, innovations in local food sources have become an important strategy for accelerating stunting reduction. Among various food ingredients, eggs hold a strategic position due to their high protein content, digestibility, wide availability across Indonesia, and relatively affordable price. Scientific evidence, including findings from the Lulun Project in Ecuador (Iannotti et al., 2017), demonstrates that consuming one egg per day significantly improves children's linear growth.

A variety of egg-based food innovations have been developed in Indonesia, such as nutrient-rich egg pudding (Qodami et al., 2024), combinations of eggs and mung bean juice (Suksesty et al., 2020), and the SETEL (Healthy with Eggs) program (Obar et al., 2024). These initiatives have shown improvements in children's nutritional status, although their success remains dependent on socioeconomic factors, family dietary habits, and local policy support.

Therefore, this article aims to review the latest scientific evidence on the role of eggs as a local food innovation for stunting prevention, assess the effectiveness of egg-based interventions, and propose integrated policy strategies to strengthen stunting reduction efforts in Indonesia.

LITERATURE REVIEW

1. Factors Contributing to Stunting

Stunting results from a combination of direct and indirect factors that influence child growth. Direct factors relate to inadequate nutrient intake and frequent infections, while indirect factors include poverty, low maternal education, and limited access to healthcare services and environmental sanitation.

A study by Oktarina & Sudiarti (2013) in Sumatra reported a stunting prevalence of 44.1% among children under five. The main contributing factors were short maternal height (OR = 1.36) and large household size (OR = 1.38). Another study by Rusliani et al. (2022) found that maternal nutritional knowledge and complementary feeding (MP-ASI) practices significantly affect children's nutritional status.

Frederica et al. (2024) further emphasized that public policies play a major role in reducing stunting. However, the implementation of government programs is often hindered by weak intersectoral coordination and limited human resources in local regions. Therefore, prevention efforts must be comprehensive, integrating nutritional education, economic empowerment, and policies that support families at risk of stunting.

2. Eggs as a High-Quality Animal Protein Source

Protein is an essential macronutrient involved in tissue formation, growth, and immune function. Protein deficiency during growth periods can hinder linear development and increase the risk of stunting (Almatsier, 2001).

Eggs are among the highest-quality sources of animal protein, with the highest biological value (BV = 100) and a complete amino acid profile. According to Bakhtra et al. (2016), the protein content of native chicken eggs reaches 6.91%, which is higher than broiler eggs (6.45%) and duck eggs (6.59%). In addition to protein, eggs contain essential vitamins and minerals such as vitamin A, B12, choline, iron, and selenium, all of which contribute to brain development and immune function (Wulandari & Arief, 2022).

Within the context of the First 1,000 Days of Life (the *Golden Period*), regular egg consumption has been shown to improve length-for-age z-scores (LAZ). The international Lulun Project in Ecuador (Iannotti et al., 2017) found that providing one egg per day for six months increased LAZ by +0.63 SD and reduced stunting prevalence by up to 47%.

3. Eggs as a Strategic Local Food for Complementary Feeding (MP-ASI)

Eggs are a local food ingredient that is easily obtained, affordable, and widely accepted by the community. In South Sumatra, the availability of native and broiler chicken eggs is abundant, making them highly suitable as a main ingredient in local complementary feeding (MP-ASI) programs (Birhanu et al., 2025).

Studies by Mamun et al. (2023) and Dewey & Adu-Afarwuah (2021) highlight that local food-based interventions containing animal protein deliver more consistent results in improving child growth compared to single-micronutrient supplementation. Additionally, maternal nutrition education on safe egg preparation (cooked to ≥70°C to prevent Salmonella contamination) is important to ensure broad community acceptance of these interventions.

4. Government Policies in Indonesia for Stunting Prevention

The Indonesian government has strengthened its commitment to accelerating stunting reduction through Presidential Regulation No. 72 of 2021, which emphasizes a family-based approach and multisectoral collaboration. This program integrates the roles of BKKBN, the Ministry of Health, and local governments in nutrition status planning and monitoring.

However, an evaluation by Frederica et al. (2024) revealed that program implementation still faces challenges, including poor cross-sector coordination and disparities in regional capacity. Therefore, leveraging local food innovations based on high-quality animal protein, such as eggs, represents a strategic and sustainable approach to bolstering national stunting reduction policies

METHODOLOGY OF THE REVIEW

1. Research Design

This review employs a **systematic literature review** approach developed based on the **PRISMA 2020 guidelines**. This approach was selected to integrate various national and international research findings that discuss egg consumption and stunting prevention efforts.

2. Sources and Inclusion Criteria

The literature search was conducted through several scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar, using the following keyword combinations:

"egg" OR "hen egg" AND "child" OR "infant" AND "growth" OR "stunting"

Articles included in this review were required to meet the following inclusion criteria:

- **Study subjects:** children aged ≤59 months;
- **Intervention:** consumption of whole eggs or egg-based processed products;
- **Outcomes:** length-for-age indicators (LAZ/HAZ), stunting prevalence, or children's nutritional status;
- **Study design:** Randomized Controlled Trial (RCT), quasi-experiment, cohort, or cross-sectional;
- **Publication year:** 2018–2025;
- **Language:** English or Indonesian.

From the selection process, **10 national and international articles** met the criteria and were included for further analysis.

3. Data Analysis

Data were analyzed using a thematic and narrative approach, grouping the research findings into four main themes:

1. Factors contributing to stunting;
2. Nutritional content and biological functions of eggs;
3. Effectiveness of egg-based food innovations;
4. Policies and strategies for implementing local nutrition programs using eggs.

Quantitative data, such as the nutritional composition of eggs and intervention outcomes of egg consumption on child growth, are presented in descriptive tables. Meanwhile, findings related to policy, education, and program implementation were analyzed qualitatively to provide a comprehensive overview.

4. Summary of Nutritional Composition of Chicken Eggs (per 100 g)

Component	Broiler Chicken	Native Chicken	Duck	Quail
Protein (%)	6.45	6.91	6.60	6.55
Fat (%)	11.8	12.3	13.1	11.9
Vitamin A (IU)	327	325	311	305
Minerals (mg)	256	248	242	230

Sources: Bakhtra et al. (2016); Wulandari & Arief (2022).

The table shows that native chicken eggs contain the highest protein levels compared to other egg types, while duck eggs contain higher fat levels. The vitamin and mineral content across all egg types indicates their strong potential as an important source of nutrients in stunting prevention efforts.

RESULTS AND DISCUSSION

1. The Role of Eggs in Improving Children's Nutritional Status

Eggs are an animal-based food with the highest protein quality compared to other protein sources such as meat and milk. Their complete profile of essential amino acids makes eggs crucial for growth processes and cellular regeneration. In addition to protein, eggs provide important micronutrients such as vitamins A, D, and B12, choline, iron, and selenium, all of which play a significant role in brain development and the immune system of children. The Lulun Project conducted by Iannotti et al. (2017) provides strong evidence of the effectiveness of egg consumption in improving children's nutritional status. In a study involving 163 children in Ecuador, daily provision of one egg for six months increased length-for-age z-scores (LAZ) by +0.63 SD, demonstrating a positive impact on linear growth.

Similar findings have been reported in Indonesia. Qodami et al. (2024) developed fortified egg pudding with added milk, honey, and fruit, which was proven

to increase protein and energy intake among children aged 2–5 years. Organoleptic assessments showed an acceptance rate of 92%, indicating strong potential for this product as a widely acceptable nutritious supplement.

2. Egg-Based Product Innovations in Stunting Prevention Interventions

The development of various egg-based food products offers solutions to challenges related to access to nutritious foods, storage limitations, and dietary monotony. The following innovations have been successfully implemented in Indonesia:

Product Innovation	Form of Intervention	Duration	Key Findings	Source
Fortified Egg Pudding	Supplemental food with milk & honey	4 weeks	Increased protein intake and child weight	Qodami et al. (2024)
Mung Bean Juice & Boiled Egg Combination	Daily provision	30 days	45.8% of children showed improved nutrition	Suksesty et al. (2020)
SETEL Program (Healthy with Eggs)	Provision of 1 egg/day	6 months	Positive trend in weight gain & child activity	Obar et al. (2024)

Studies conducted in various regions demonstrate that regular consumption of eggs, both fresh and processed, significantly improves child weight and height. Intervention success is also influenced by societal acceptance and family dietary habits. However, effectiveness is not solely determined by the food product itself. Factors such as maternal nutrition education, supervision of consumption at home, and local policy support also play essential roles in the success of egg-based programs.

3. Effectiveness of Eggs in Community-Based Nutrition Interventions

Community-based approaches have proven effective in enhancing adherence and improving program outcomes. An example is the SETEL (Healthy with Eggs) Program in South Sulawesi, which involves active community participation through health volunteers (*kader posyandu*) and women's groups (PKK). Although weight gain was not statistically significant ($p > 0.05$), the program succeeded in promoting better family eating behaviors.

The Community-Based Nutrition Theory emphasizes that the success of nutrition interventions depends largely on community participation, not merely food availability (Dewey & Adu-Afarwuah, 2021). Eggs are easily integrated into household diets without requiring changes to local food culture. Innovations such as fortified egg biscuits and instant egg powder (Wulandari & Arief, 2022) also enhance shelf life and facilitate distribution in remote areas.

4. Linkages Between Food Innovation and National Policy

The implementation of egg-based food innovations must align with national policies aimed at accelerating stunting reduction. Presidential Regulation No. 72 of 2021 provides a legal framework for cross-sectoral integration in nutrition interventions.

According to Frederica et al. (2024), the main challenges in implementing this policy include interagency coordination issues and disparities in regional capacity. However, the family-based stunting risk approach developed by BKKBN has begun to show positive results by emphasizing nutrition education and growth monitoring. From an economic perspective, eggs have strategic value as both a nutritional commodity and a driver of local economic empowerment. Increasing egg consumption not only improves child nutrition but also supports the growth of poultry farmers and small-scale food enterprises (UMKM). Thus, egg-based food innovations serve a dual function as a nutrition-sensitive intervention and a catalyst for local economic development.

5. Challenges and Opportunities in Program Implementation

Despite promising results from various innovations, several key challenges remain:

1. **Limited nutrition education among families.** Some communities still believe myths such as eggs causing excessive "heatiness" or allergies.
2. **Uneven distribution and price disparities.** In remote areas, egg prices may be 30% higher than in urban regions.
3. **Inconsistent program monitoring and evaluation.** Many programs do not routinely apply WHO-standard anthropometric measurements (weight-for-age and height-for-age).

4. **Storage and food safety limitations.** Fresh eggs have a short shelf life; therefore, innovations such as egg powder need broader development.
5. **Weak cross-sector coordination.** Programs at the community level often operate separately among the Health Office, BKKBN, and the Agriculture Office.

Nevertheless, opportunities for strengthening programs are considerable, especially through multisector collaboration and digital technologies. Integrating nutrition monitoring systems such as the BKKBN Family Data Dashboard and the e-PPGBM application can support real-time identification of children at risk of stunting and accelerate data-driven decision-making.

6. Integrated Model of Egg Innovation and Nutrition Policy

An integrated approach between local food innovations and national policy can be illustrated through the following four key components:

1. **Local Food Production and Distribution:** Strengthening the capacity of poultry farmers and small-scale egg-processing enterprises.
2. **Specific Nutrition Interventions:** Providing eggs, fortified egg pudding, or egg-based fortified products to children at risk of stunting.
3. **Education and Behavior Change:** Training families and health volunteers on the importance of animal protein for child growth.
4. **Integrated Monitoring and Evaluation:** Utilizing digital data systems to monitor program effectiveness across regions.

This framework aligns with the concept of **"Farm to Family Nutrition Integration,"** which connects the food, health, and social sectors sustainably to achieve faster and more effective stunting reduction.

CONCLUSION

Eggs are a high-quality animal protein source with substantial potential to support the acceleration of stunting reduction in Indonesia. Based on findings from national and international literature, regular egg consumption has been proven to

increase children's linear growth, improve nutritional status, and reduce stunting prevalence by up to nearly 50% in several studies.

Various egg-based food innovations—such as egg pudding, a combination of mung bean juice and boiled eggs, and egg-fortified products—have shown positive outcomes in both nutritional value and community acceptance. However, the effectiveness of these interventions is strongly influenced by family nutrition education, accessibility of nutritious foods, and coordinated multisectoral efforts.

The national policy through Presidential Regulation No. 72 of 2021 provides a strategic framework for accelerating stunting reduction. Nevertheless, its implementation at the local level needs to be strengthened through community-based nutrition approaches that utilize local food resources, such as eggs, as a primary protein source. Collaboration between food innovation, nutrition education, and government policies is essential for establishing a sustainable child nutrition program in Indonesia.

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