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MORALITY BEFORE KNOWLEDGE

The collaborative research and education system on poultry and eggs (CRESCOVA) to achieve balanced nutrition and prevent stunting

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ABSTRACT

Background: Stunting remains one of Indonesia's most critical public-health challenges, affecting child growth, cognitive development, and long-term human-capital productivity. Despite national efforts to accelerate stunting reduction, gaps persist in dietary diversity, nutrition literacy, and integration between health and agricultural sectors. Poultry and eggs—nutrient-dense, affordable, and widely acceptable—represent a strategic yet underutilized entry point for improving child nutrition. This study aims to synthesize interdisciplinary evidence and develop the CRESCOVA (Collaborative Research and Education System on Poultry and Eggs) framework as an innovative model that integrates nutrition education, small-scale poultry practices, and community empowerment to support Indonesia's stunting-reduction agenda. **Method:** This research employed a qualitative descriptive literature-review design. A systematic search was conducted across Scopus, PubMed, Web of Science, ScienceDirect, DOAJ, Google Scholar, FAO, WHO, UNICEF, World Bank, Ministry of Health of the Republic of Indonesia, and National Population and Family Planning Agency repositories (2019–2025), supplemented with foundational meta-analyses. A total of 52 eligible sources were analyzed using narrative thematic synthesis, covering nutrition-sensitive agriculture, animal-source foods, community-based education, and cross-sector collaboration. Extracted themes were integrated to construct the CRESCOVA conceptual model and validated against national policies and global development frameworks. **Finding:** Results show consistent evidence that egg and poultry consumption significantly improves linear growth and dietary adequacy among children, while participatory nutrition education enhances caregiver behavior. Cross-sector interventions linking health, education, and agriculture demonstrate greater impact than fragmented programs. Based on these findings, the CRESCOVA model offers a scalable, context-appropriate framework that strengthens household capacity, promotes women's empowerment, and aligns with SDG 2 and SDG 3 to improve food security and child nutrition outcomes. **Conclusion:** CRESCOVA provides a practical strategy to operationalize multisectoral stunting-reduction efforts through integrated education and poultry-based learning. Further field implementation and evaluation are recommended to assess feasibility across Indonesia's diverse regions. **Novelty/Originality of this article:** This study introduces the CRESCOVA framework as a novel socio-technical intervention that specifically bridges the gap between nutrition-sensitive agriculture and public health education in the Indonesian context.

KEYWORDS: stunting; poultry; eggs; nutrition-sensitive agriculture; community empowerment; CRESCOVA model; Indonesia.

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1. Introduction

Stunting remains one of the most pressing public-health problems in Indonesia, reflecting chronic malnutrition and long-term deficiencies of essential nutrients during early childhood. According to the Indonesia Nutrition Status Survey (SSGI, 2024), the national prevalence of stunting among children under five reached 21.5 % still far from the global target of below 14 % by 2030 (Kemenkes RI, 2024). This condition not only impairs linear growth but also affects cognitive development, school performance, and adult productivity (Black et al., 2020). Stunting contributes to the intergenerational cycle of poverty and inequality, which ultimately hampers Indonesia's human-capital development.

The underlying causes of stunting are multifactorial ranging from inadequate dietary diversity and infectious diseases to poverty and low nutrition literacy (Dewey & Begum, 2022). Protein of animal origin, particularly poultry and eggs plays an essential role in improving linear growth, immune function, and micronutrient adequacy among children. Eggs are rich in high-quality protein, choline, vitamin A, iron, and zinc nutrients that are often lacking in traditional rice-based diets (Bellizzi et al., 2022). A meta-analysis reported that daily egg consumption significantly reduces the risk of stunting in developing countries (Gebrekidan et al., 2021). Despite this evidence, per-capita intake of animal-source foods in Indonesia remains low compared with other ASEAN countries, largely due to income inequality, food price volatility, and limited awareness of balanced nutrition (FAO, 2023).

The Government of Indonesia has intensified its commitment through the National Strategy to Accelerate Stunting Reduction 2021–2030 issued by National Population and Family Planning Agency/*Badan Kependudukan dan Keluarga Berencana Nasional (BKKBN)* (2021). This national roadmap emphasizes convergence among the health, agriculture, and education sectors. However, many community-based programs remain fragmented, focusing mainly on supplementation and health promotion rather than long-term behavioral change. The poultry sector, which provides an affordable and scalable source of animal protein, is still underutilized in community nutrition initiatives (Di Prima et al., 2022). A policy and research gap persists: numerous studies highlight the nutritional benefits of poultry and eggs, yet few investigate how these can be operationalized through integrated education and local empowerment.

Recent analyses have highlighted that the persistence of stunting in Indonesia is not merely a matter of food scarcity but a reflection of systemic inequality in knowledge, accessibility, and local governance. While the country has made significant progress in health infrastructure, disparities remain wide across provinces. Eastern regions such as East Nusa Tenggara, Papua, and West Sulawesi continue to report stunting rates exceeding 30 % double those in major urban areas like Jakarta and Yogyakarta. These geographical gaps are driven by uneven resource distribution, limited cold-chain systems for perishable foods, and insufficient integration of local food potentials into national nutrition planning. Strengthening local food systems through community participation and education thus becomes a strategic priority to ensure that nutrition interventions reach the most vulnerable populations.

Moreover, the issue of nutrition literacy among caregivers remains a critical barrier. Studies show that many households are unaware of the nutritional value of eggs and poultry, associating them primarily with economic assets rather than daily food sources. Misconceptions about cholesterol and dietary taboos further limit consumption, especially among low-income families. Therefore, culturally sensitive and contextually tailored education is vital to shift perceptions and improve dietary habits sustainably.

By linking these behavioral dimensions with local production initiatives, integrated models such as CRESCOVA can serve as a bridge between scientific evidence and community understanding. This approach enables behavioral change through knowledge transfer, demonstration activities, and participatory workshops, promoting long-term transformation rather than short-term compliance. Beyond nutrition itself, stunting represents a broader social and developmental issue influenced by socioeconomic disparities, environmental sanitation, and cultural feeding practices. Evidence from the

World Health Organization (2024) suggests that children from rural areas and lower-income households are twice as likely to experience stunting compared to those living in urban regions. This disparity underscores the need for a multidimensional approach linking food access, education, and income generation rather than treating stunting as a health problem alone.

National policies such as *Gerakan Nasional Percepatan Perbaikan Gizi* and *Gerakan Masyarakat Hidup Sehat (GERMAS)* have laid the foundation for nutrition and sanitation improvements. However, implementation at the community level still faces challenges, including limited human resources, insufficient monitoring, and the absence of engaging, context-specific learning models. A participatory and collaborative educational framework is therefore essential to transform knowledge into sustainable action at the household level.

In this context, the poultry sector holds significant potential as a medium for practical nutrition education. Household-based poultry rearing and egg utilization can simultaneously provide accessible animal protein and serve as experiential learning tools. Families learn directly about food sources, dietary diversity, and economic self-reliance through hands-on practice. This aligns with the *nutrition-sensitive agriculture* paradigm, which integrates agricultural productivity with health and educational outcomes (FAO, 2021). Compared with other livestock, poultry offers a low-cost and culturally acceptable option adaptable to rural and peri-urban environments.

To address the gap between research, policy, and community practice, the CRESCOVA Model (Collaborative Research and Education System on Poultry and Eggs) was developed as an innovative framework linking nutrition education, livestock development, and community empowerment. CRESCOVA integrates knowledge from public health, animal science, and education to promote balanced diets through participatory learning. It repositions poultry and eggs not merely as food commodities but as *educational entry points* to strengthen household awareness, improve dietary diversity, and empower local farmers. The model aligns with SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-Being) by linking food production, nutrition literacy, and social inclusion (FAO, 2014).

A growing body of literature demonstrates that nutrition-sensitive agriculture**,** which integrates food production, education, and women's empowerment, can lead to measurable improvements in child growth outcomes (Young et al., 2020). Programs implemented in rural Africa and South Asia show that coordinated, cross-sector interventions enhance dietary diversity and household food security (Di Prima et al., 2022). Yet, adaptation of such models in Indonesia remains limited. Studies have indicated that smallholder poultry systems could significantly improve access to animal protein if coupled with structured nutrition-education efforts (Gizi Indonesia, 2022). Integrating poultry-based learning modules into existing community infrastructures such as Integrated Service Center/*Pos Pelayanan Terpadu* (*Posyandu*) and Family Empowerment and Well-being/*Pemberdayaan dan Kesejahteraan Keluarga* (*PKK*) groups would allow economic and health improvements to occur concurrently at the grassroots level.

Cross-sector collaboration also encourages innovation and knowledge co-creation. When universities, health centers, and farmer groups co-design interventions, outcomes are more sustainable and contextually relevant. Incorporating poultry-related modules into public health and vocational curricula can help students understand food systems and malnutrition holistically. In parallel, digital learning platforms expand accessibility and participation, enabling nutrition and agriculture content to reach broader audiences efficiently. This embodies the One Health paradigm, emphasizing the interconnectedness of human, animal, and environmental health. From a policy standpoint, the CRESCOVA framework contributes directly to Indonesia's 2045 Golden Generation vision, aiming to improve the quality of human capital through innovation and collaboration. By strengthening intersectoral partnerships and fostering community-led education, this model enhances local food systems and resilience to nutrition crises (World Bank, 2023a). It also bridges scientific research with actionable policies, reinforcing national initiatives like *GERMAS* and *Program Kampung Gizi*. In doing so, CRESCOVA exemplifies how localized,

evidence-based interventions can drive sustainable transformation in public health and food security.

To ensure that such integrative efforts yield measurable results, cross-sector coordination must be institutionalized within Indonesia's education and nutrition policies. The implementation of CRESCOVA at the local level requires commitment from regional governments, universities, and community leaders to sustain capacity-building and monitoring. Embedding this model within existing public-health curricula and agricultural extension programs could provide long-term continuity, enabling young generations to internalize nutrition awareness as part of everyday learning. Strengthening these structural linkages will determine whether Indonesia can translate innovative frameworks into sustainable outcomes for future generations. This collaborative foundation is expected to accelerate Indonesia's progress toward achieving SDG targets on nutrition, health, and sustainable food systems.

Ultimately, this study employs a literature-based qualitative descriptive approach to synthesize both national and international evidence, developing the CRESCOVA framework as a practical model for nutrition-sensitive poultry education in Indonesia. By reviewing scholarly articles, policy documents, and field experiences, this paper identifies mechanisms through which collaborative systems in poultry and egg education can increase community awareness, reduce stunting, and improve household welfare. The expected contribution is to provide a scalable, integrative model that bridges science, education, and policy supporting Indonesia's long-term commitment to achieving balanced nutrition and sustainable development.

2. Methods

The Methods section outlines the procedures used to identify select, extract, and analyze relevant literature to develop the CRESCOVA framework. As this research adopts a qualitative descriptive literature-review approach, the methodological process emphasizes transparency, replicability, and rigor consistent with established evidence-synthesis standards (Snyder, 2019; Whittemore & Knafl, 2005). The following subsections describe the study design, search strategies, inclusion and exclusion criteria, data extraction, thematic synthesis procedures, and ethical considerations adopted throughout the research.

2.1 Study design

This study employed a literature-based qualitative descriptive design aimed at synthesizing scientific evidence related to nutrition-sensitive agriculture, poultry-based interventions, and stunting prevention. This approach was selected because the study focuses on developing a conceptual and integrative model the CRESCOVA Framework rather than generating primary empirical data. A qualitative descriptive review enables the integration of interdisciplinary evidence from public health, nutrition, agriculture, and education, and allows contextualization within Indonesia's national stunting priorities. The design also supports the identification of gaps, patterns, and opportunities for cross-sector collaboration relevant to community-based nutrition interventions.

The methodological structure follows established standards for narrative synthesis, including systematic search procedures, predetermined inclusion criteria, critical appraisal of literature, and thematic analysis. By combining peer-reviewed scientific journals, government reports, and international policy documents, this study presents a comprehensive foundation for constructing an innovative, context-specific model for nutrition education using poultry and eggs as primary entry points. This approach enables structured integration of diverse interdisciplinary evidence supporting the conceptual model (Snyder, 2019; Whittemore & Knafl, 2005).

2.2 Data sources and search strategy

The literature search was conducted between January–February 2025 across multiple major academic and institutional databases to ensure wide coverage and minimize publication bias. Databases included Scopus, PubMed, Web of Science, ScienceDirect, DOAJ, and Google Scholar, as well as internationally recognized institutional repositories such as FAO, WHO, UNICEF, World Bank**,** and the Ministry of Health of Indonesia**.** Supporting documents including national strategies, government guidelines, datasets, and regional reports were also reviewed to contextualize findings within Indonesian policy frameworks. A systematic search strategy was implemented using combinations of keywords and Boolean operators, adapted to each database's indexing structure. The core keywords included: "stunting", "child undernutrition", "linear growth"; "nutrition-sensitive agriculture", "poultry sector", "egg consumption"; "animal-source foods", "community nutrition education"; "collaborative model", "cross-sector intervention"; "Indonesia", "food systems", "public health nutrition".

Sample search strings included: "stunting AND eggs AND children AND Indonesia"; "poultry sector AND nutrition-sensitive agriculture"; "community-based nutrition education AND animal-source foods"; "collaboration AND agriculture AND public health". A systematic search approach was used to enhance transparency and reduce selection bias (Okoli, 2015; Haddaway et al., 2020). The search was limited to publications from 2019–2025 to capture the most recent evidence associated with stunting-reduction initiatives in Indonesia and updated findings from global nutrition agencies. Older studies (before 2019) were included only when providing essential foundational concepts, such as well-established meta-analyses. All searches were conducted in English or Bahasa Indonesia.
To ensure search completeness, backward and forward citation tracking was performed, allowing the identification of relevant studies cited by or citing the primary articles. Grey literature from reputable organizations was included selectively when methodological robustness and relevance to the Indonesian context were evident.

2.3 Inclusion and exclusion criteria

To ensure methodological rigor, predefined inclusion and exclusion criteria were applied to all retrieved documents. Inclusion criteria, eligible literature met the following conditions: topic relevance, addressed stunting, child nutrition, poultry/egg interventions, animal-source foods, community empowerment, food systems, or cross-sector health–agriculture collaboration. Publication type, peer-reviewed journal articles (original research, meta-analyses, systematic reviews). Reputable institutional reports (FAO, WHO, UNICEF, World Bank, Ministry of Health of the Republic of Indonesia/*Kementerian Kesehatan Republik Indonesia*, National Population and Family Planning Agency/*Badan Kependudukan dan Keluarga Berencana Nasional (BKKBN)*). Time frame, published between 2019–2025 (or earlier if foundational). Geographical relevance, conducted in Indonesia or LMICs with comparable socioeconomic conditions; accessibility, full text available; language, english or Indonesian.

Exclusion criteria, literature was excluded if it lacked methodological clarity or did not specify research procedures. It consisted of opinions or commentaries without empirical evidence. It focused solely on livestock production without nutritional or public-health relevance. It contained duplicate findings or low methodological quality. The study population was not relevant (e.g., elderly, adolescents, non-human subjects). The context was too distant from Indonesia's food system (e.g., high-income industrial agriculture contexts). After applying these criteria, approximately 85 documents were screened. A total of 52 sources were retained for full synthesis because they directly supported the development of the CRESCOVA Framework. The screening and selection followed transparent reporting standards consistent with PRISMA guidelines (Moher et al., 2020).

2.4 Data extraction and analysis

Information from each eligible study was extracted using a structured matrix. Data categories included: study characteristics, target populations, intervention types, measured outcomes, mechanisms of change, relevance to poultry and egg utilization, and implications for Indonesian public-health and agricultural contexts. Data analysis followed a narrative thematic synthesis approach, consisting of initial coding to identify key concepts. Grouping codes into broader thematic categories, such as nutrition-sensitive agriculture, cross-sector collaboration, household poultry utilization, and community education models. Integration and interpretation to derive components relevant to the development of the CRESCOVA conceptual framework.

This analytical process emphasized recurrent evidence demonstrating the role of animal-source foods particularly eggs in improving linear growth, the effectiveness of community-based learning in shaping dietary behavior, and the potential synergy between agricultural and health sectors. Findings were compared across geographic and socioeconomic contexts to identify adaptable practices for Indonesia. The narrative and thematic synthesis procedures followed established methodological guidance (Popay et al., 2006; Thomas & Harden, 2008; Bearman & Dawson, 2013).

To enhance analytical rigor, extracted literature was reviewed comparatively to identify variations in mechanisms, effectiveness of intervention, and contextual factors influencing outcomes. Studies were categorized into domains such as dietary diversity, animal-source food accessibility, community-learning effectiveness, and household economic strengthening. This multilayered analysis strengthened the conceptual foundation underlying CRESCOVA and ensured its applicability for community implementation. This analytic process ensured that patterns were not only identified but also meaningfully connected to broader public-health priorities, strengthening the reliability and applicability of the synthesized findings.

2.5 Conceptual framework development and ethical consideration

The CRESCOVA Framework was developed using an iterative evidence-to-concept process. Development proceeded through four stages as follows in Table 1. Furthermore, this study did not involve human subjects, primary data collection, or experimental procedures; therefore, ethical clearance was not required. Nevertheless, ethical principles for literature-based research were upheld, including accurate attribution, avoidance of plagiarism, responsible interpretation of evidence, and transparent reporting of methodological steps (Snyder, 2019).

This four-stage approach is designed to ensure that the conceptualization process is comprehensive, structured, and grounded in robust evidence. Each stage is sequential and interconnected, with the mapping of initial findings serving as the foundation for formulating core components before they are ultimately integrated into a cohesive model. Ultimately, the validation stage confirms that the resulting CRESCOVA framework is not only theoretically sound but also practical and aligned with national and global health policy agendas.

Table 1. Methodological steps for evidence mapping and model integration

Stage	Description
Evidence Mapping	Key determinants of stunting, nutritional benefits of poultry and eggs, and components of successful nutrition–agriculture programs were mapped to outline potential causal pathways.
Identification of Core Components	Themes were consolidated into three domains: 1. Nutrition Education (caregiver knowledge, student modules, community workshops). 2. Livestock Development (household poultry rearing, egg accessibility, local production systems).

	3. Community Empowerment (economic strengthening, participatory learning, women's involvement).
Integration and Model Structuring	Components were organized into a coherent framework linking educational pathways, poultry production practices, and community-led initiatives. The integrated model reflects collaborative partnerships among government institutions, universities, health workers, and smallholder farmers.
Validation Against Policy and Global Frameworks	The model was aligned with national strategic targets (BKKBN, Kemenkes), the Sustainable Development Goals (SDG 2 and SDG 3), and international nutrition guidance to ensure policy coherence and practical feasibility.

3. Results and discussion

This section presents the synthesized findings from the reviewed literature and discusses their implications for the development of the CRESCOVA model. Results are organized thematically to reflect evidence on stunting determinants, the role of poultry and eggs in improving child nutrition, the effectiveness of community-based education, and the relevance of cross-sector collaboration. By combining international and Indonesian sources, this section provides a comprehensive interpretation of how nutrition-sensitive agriculture and community empowerment can contribute to reducing stunting.

The discussion further integrates empirical evidence with Indonesia's policy landscape, highlighting opportunities and barriers in implementing poultry-based nutrition interventions at the community level. The synthesis emphasizes the importance of education, accessibility, behavioral change, and institutional support. These thematic insights serve as the foundation for structuring the CRESCOVA framework as a practical and scalable model for promoting balanced nutrition, strengthening food systems, and supporting national stunting-reduction targets.

3.1 Overview of included evidence

The final synthesis included 52 studies and institutional reports that met the eligibility criteria and directly supported the conceptualization of the CRESCOVA model. Most international studies confirmed that stunting remains strongly associated with chronic nutrient deficiencies, insufficient dietary diversity, infectious disease, and socioeconomic disparities (Black et al., 2020). Evidence from low- and middle-income countries shows that inadequate intake of animal-source foods (ASFs), particularly eggs and poultry continue to contribute to growth faltering among children under five (Bellizzi et al., 2022). Meta-analyses highlight that regular egg consumption significantly improves linear growth and reduces the risk of stunting, especially when combined with caregiver nutrition education (Gebrekidan et al., 2021).

Indonesian studies provide a more contextualized understanding of stunting determinants, including persistent regional disparities, limited household purchasing power, and cultural misconceptions surrounding egg consumption. National surveys such as SSGI illustrate that provinces with limited access to ASFs and weak food-system infrastructure consistently report higher stunting prevalence. Government policy documents including BKKBN's National Strategy to Accelerate Stunting Reduction emphasize the need for convergence of multisector programs but acknowledge gaps in community-level implementation (BKKBN, 2021).

Evidence supporting the integration of poultry-based education primarily comes from community nutrition programs in Africa, South Asia, and parts of Southeast Asia, where household poultry rearing successfully improved protein intake, caregiver knowledge, and household food security. Studies on nutrition-sensitive agriculture consistently show that combining food production with education increases dietary diversity and strengthens local resilience (Di Prima et al., 2022). These findings collectively highlight the relevance of

poultry and egg interventions within Indonesia's long-term strategy for stunting reduction and justify the development of the CRESCOVA model.

3.2 The Role of poultry and eggs in enhancing child nutrition

Evidence consistently demonstrates that poultry and eggs are among the most effective and affordable sources of high-quality protein for improving child growth, especially in low- and middle-income countries. Eggs contain essential amino acids, choline, vitamin A, B vitamins, iron, and zinc micronutrients commonly lacking in the diets of young children in Indonesia (Bellizzi et al., 2022). Multiple randomized controlled trials have shown that routine egg consumption significantly improves linear growth, reduces stunting risk, and enhances cognitive development (Bzikowska-Jura, 2021). Compared with other livestock commodities, poultry products are low-cost, widely acceptable, and adaptable to small-scale household production systems, making them ideal for nutrition interventions targeting vulnerable communities.

In Indonesia, disparities in access to animal-source foods continue to shape stunting prevalence across regions. Furthermore, the children from households with regular egg consumption had higher height-for-age scores than those with limited access. Yet cultural taboos, misconceptions about cholesterol, and economic constraints still limit egg intake among low-income families. Strengthening poultry supply chains and embedding nutrition education within community platforms such as Integrated Service Center/*Pos Pelayanan Terpadu (Posyandu)* and Family Empowerment and Well-being/*Pemberdayaan dan Kesejahteraan Keluarga (PKK),* and school-based programs are therefore essential.

Global literature also demonstrates that integrating poultry production with caregiver education leads to improvements not only in dietary diversity but also household economic resilience. Household poultry rearing is associated with increased protein availability, improved women's decision-making power, and enhanced food security (Di Prima et al., 2022). These findings reinforce the relevance of using poultry and eggs as the core entry points in the CRESCOVA model. By merging production, education, and empowerment, poultry-based interventions can produce sustained improvements in child nutrition while strengthening local livelihoods.

3.3 Community-based nutrition education and behavioral change

Nutrition education has long been recognized as one of the most effective strategies for improving caregiver knowledge and shaping healthy feeding practices. Studies show that when communities receive structured, context-specific, and participatory learning, dietary behaviors improve significantly even in low-resource settings (Young et al., 2020). Education is particularly critical in Indonesia, where nutrition literacy varies widely and misconceptions about food persist. For example, many caregivers view eggs as luxury items or avoid giving them to young children due to myths related to allergies and cholesterol (Gizi Indonesia, 2022).

Evidence from community programs in South Asia and Africa demonstrates that participatory education such as cooking demonstrations, peer-group learning, and home visits has stronger impacts than one-directional counseling (Di Prima et al., 2022). When communities are directly involved in the learning process, they are more likely to internalize knowledge, adopt new feeding behaviors, and sustain them long term. This is consistent with Indonesia's community health structure, where *Posyandu cadres, PKK* groups, and youth organizations play central roles in disseminating health information.

Furthermore, integrating poultry-based modules into nutrition education strengthens engagement by providing tangible, relatable examples. Teaching caregivers how eggs contribute to growth, how to prepare them safely, and how to optimize household poultry production has been shown to increase protein intake more effectively than generic nutrition messages alone. Programs that combine education with practical demonstrations

such as raising chickens, managing household egg production, or budgeting for ASF consumption yield stronger behavioral outcomes.

Community empowerment also amplifies these results. Women who participate in training gain greater confidence, control over household food decisions, and opportunities for microenterprise development (Dunne et al., 2021). This combination of knowledge, skill, and agency forms one of the core pillars of CRESCOVA, ensuring that nutrition interventions extend beyond awareness and evolve into consistent, sustained dietary improvements.

3.4 Cross-sector collaboration and integration potential

Reducing stunting requires a systems-based approach that connects health, agriculture, education, and community development. Cross-sector collaboration enables the sharing of resources, knowledge, and responsibilities, resulting in more comprehensive interventions. Evidence shows that programs involving universities, health workers, agricultural extension officers, and community leaders achieve better outcomes than single-sector efforts (Gracia et al., 2020). This integrated approach also ensures that each sector understands its role in the nutrition cycle, so that interventions target not only medical aspects but also structural root causes such as food availability, consumption patterns, and access to education.

In Indonesia, stunting-reduction efforts have historically been fragmented, with sectors working in parallel rather than in coordinated frameworks (BKKBN, 2021). Nutrition programs often emphasize supplementation and counseling, while agricultural programs focus on production without integrating nutritional objectives. The CRESCOVA model addresses this gap by creating convergence linking nutrition education, poultry system development, and community empowerment within one unified framework. In addition, CRESCOVA also promotes cross-institutional collaboration so that all local-level activities share a common direction and reinforce one another, rather than operating in isolation.

Findings from multi-country studies demonstrate that nutrition-sensitive agriculture becomes significantly more effective when embedded in educational and health structures (Di Prima et al., 2022). For instance, school-based agricultural programs that teach students about poultry, eggs, and balanced diets have been shown to improve nutrition literacy across entire communities. Similarly, agricultural extension programs that collaborate with health workers increase ASF availability and reduce household food insecurity. This initiative fosters the habit of consuming animal protein from an early age and reinforces a culture of nutritious eating at the family level.

Digital platforms further enhance collaboration by enabling universities and government agencies to deliver nutrition and poultry-learning content to broader audiences at low cost. Such innovations align with Indonesia's national goals, including GERMAS and the 2045 Golden Generation vision, which emphasize education, technological integration, and community resilience. Technology also extends the reach of education to remote areas, making the transfer of knowledge faster, more interactive, and more sustainable.

Collectively, these findings underscore the importance of a coordinated system like CRESCOVA. By integrating expertise across sectors, the model supports sustainable improvements in child nutrition, enhances community capacity, and drives long-term progress toward SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-Being). The integration of evidence gathered from nutritional, behavioral, agricultural, and multisectoral studies reveals a clear need for a coordinated, community-based system to address stunting through nutrition-sensitive agriculture particularly egg and poultry utilization. The synthesis of findings demonstrates three recurring and interconnected foundations: nutritional adequacy, household capacity, and system-level collaboration. These pillars directly inform the structure of the CRESCOVA Model, ensuring that each component is grounded in empirical evidence and aligned with real community needs.

Nutritional evidence highlights that eggs and poultry serve as accessible, high-quality animal-source protein essential for linear growth, cognitive development, and micronutrient adequacy (Shea & Booth et al., 2022). Meanwhile, behavioral and community studies show that nutrition education alone is insufficient unless linked to hands-on, context-specific demonstrations that caregivers can easily adopt at home (Young et al., 2020). Agriculture-focused research further underscores that smallholder poultry systems can sustainably improve food availability and household income when supported through proper training, extension services, and the empowerment of women. These findings confirm that ASF consumption is determined not only by nutritional knowledge, but also by access, production capacity, and the family's social environment

Fig. 1. The CRESCOVA program logbook for monitoring animal protein intake in toddlers.

Synthesizing these strands of evidence shows that single-sector interventions do not generate long-term impact. Supplementation-focused programs fail to build household resilience, while agricultural programs without nutrition components rarely translate into improved child feeding practices. The CRESCOVA Model addresses these gaps by integrating education, poultry production, and community empowerment into a unified operational system. This integration reduces program fragmentation, strengthens cross-sector coordination, and ensures that each activity from egg production to household feeding functions as a reinforcing cycle.

Policy analysis (BKKBN, 2021; FAO, 2023) also indicates that while Indonesia encourages program convergence, there remains no structured, community-level operational model that connects agriculture and nutrition in a practical way. The CRESCOVA Model fills this gap by providing a clear, adaptable pathway that links caregivers, students, farmers, health workers, and local governments. This model translates global best

practices into implementation mechanisms that are appropriate to the social, cultural, and economic context of Indonesia society. Overall, the integrated evidence strongly supports the development of the CRESCOVA Model as both theoretically sound and practically applicable. This model has the potential to increase household food diversity, strengthen nutrition literacy, and support the achievement of national targets for accelerating the reduction of stunting through a coordinated and sustainable approach.

3.5 Strengths and innovation of the CRESCOVA model

The CRESCOVA model introduces several innovations that distinguish it from conventional nutrition interventions. First, it integrates nutritional education with poultry-based learning, allowing households to simultaneously gain knowledge and practical skills. This dual approach is supported by evidence showing that behavior change improves when communities engage in hands-on activities such as egg preparation, poultry handling, and micro-farming demonstrations (Di Prima et al., 2022). Combining education with tangible experiences increases retention, motivation, and long-term adoption. In addition to improving technical skills, this approach reduces misconceptions about animal-based food safety and strengthens public confidence in the consumption of high-quality protein. Second, CRESCOVA emphasizes participatory learning, a method shown to be more effective than directive or lecture-based communication (Young et al., 2020). Activities such as village workshops, school projects, and farmer-to-farmer mentoring foster peer learning and strengthen community involvement. This participatory design enhances social cohesion and collective responsibility for nutrition improvement, factors known to drive sustainable lifestyle changes. This active participation also fosters dialogue among the health, education, and agriculture sectors, making the learning process more relevant to local needs.

Third, the framework explicitly elevates women's role in nutrition and livestock activities. Research consistently indicates that women's empowerment, decision-making power, and financial involvement significantly improve dietary outcomes for children (Dunne et al., 2021). CRESCOVA incorporates this by facilitating women-led micro-enterprises, household poultry production, and community nutrition groups. By positioning women as central actors, the model encourages inclusive economic participation and strengthens household food security. The impact extends not only to children's nutritional status but also to improving women's financial literacy and self-reliance.

Fourth, CRESCOVA aligns with One Health principles by integrating human nutrition, animal health, and environmental considerations. It encourages safe poultry practices, waste management, and responsible antibiotic use essential for preventing zoonotic risks and ensuring sustainable production. This integration offers a holistic perspective that human health cannot be separated from safe livestock practices and a well-preserved environment.

Finally, the model is inherently scalable. Its modular structure allows schools, *Posyandu*, universities, and agricultural programs to adopt and adapt components according to local needs. Supported by digital-learning tools, CRESCOVA can reach remote communities and strengthen national capacity building. Digitization expands the reach of training, simplifies monitoring, and improves the efficiency of implementation across various regions. Together. Together, these strengths illustrate that CRESCOVA is not only innovative but also feasible, culturally adaptable, and aligned with policy priorities making it a promising model for accelerating stunting reduction efforts in Indonesia.

3.6 Potential barriers to implementation

Although the CRESCOVA model offers significant promise, its implementation may face several barriers. One key challenge is resource availability. Many rural communities still lack stable access to quality feed, veterinary services, and basic poultry-raising infrastructure (FAO, 2023). Without addressing supply-chain disparities, households may

struggle to sustain poultry-based practices in the long term. In some regions, transportation difficulties and high input prices further limit the scalability of smallholder poultry systems (Bamidele et al., 2023). Additionally, limited funding for community-driven programs can hinder training continuity, field supervision, and routine monitoring activities that are essential for maintaining program quality.

Cultural and behavioral obstacles also pose challenges. Misconceptions about egg consumption such as beliefs that eggs cause allergies, excessive heat in children, or high cholesterol remain prevalent in certain regions of Indonesia (Gizi Indonesia, 2022). These misconceptions often stem from generational norms, limited access to accurate information, and social influence. Overcoming these requires culturally sensitive communication, the involvement of community leaders, and the use of trusted local channels to ensure message acceptance. Without tailored strategies, nutrition education may be rejected or only partially adopted.

Capacity limitations among local health workers and agricultural extension officers may also affect program implementation. Many areas face shortages of trained personnel, and existing staff are often burdened with multiple responsibilities. High workload reduces the ability to deliver interactive, continuous, and interdisciplinary education sessions as required by the CRESCOVA model. Variability in staff competency levels particularly in integrating agriculture and nutrition topics can lead to inconsistent delivery quality.

Moreover, socioeconomic inequality strongly influences the model's adoption. Low-income families may prioritize income-generating livestock practices rather than household consumption, limiting the direct nutritional benefit for children. For some households, financial instability makes it difficult to invest in poultry maintenance, housing, or biosecurity equipment. Programs must therefore integrate economic incentives, microfinance schemes, or cooperative-based income models to ensure inclusivity and sustained engagement.

Finally, coordination barriers across government agencies remain a consistent issue. Fragmentation between agricultural, health, and education sectors can cause program delays, unclear roles, overlapping activities, and limited data sharing (BKKBN, 2021). Weak intersectoral communication at the district and village levels may impede the establishment of a unified implementation roadmap. Without strong policy enforcement, adequate leadership support, and long-term funding mechanisms, the CRESCOVA model may not achieve its full potential. Addressing these barriers requires strengthening multisectoral governance, increasing community ownership, and ensuring program sustainability through continuous capacity building.

3.7 Policy implications and alignment with SDGs

The CRESCOVA framework has strong relevance for Indonesia's national policy landscape, particularly the National Strategy to Accelerate Stunting Reduction 2021–2030. By integrating nutrition education with poultry-based livelihood development, the model supports the roadmap's pillars of convergence, community empowerment, and household-level behavior change (BKKBN, 2021). CRESCOVA operationalizes convergence by providing a clear mechanism for collaboration among Integrated Service Center/*Pos Pelayanan Terpadu* (*Posyandu*, Family Empowerment and Well-being/*Pemberdayaan dan Kesejahteraan Keluarga* (*PKK*), universities, extension workers, and farmers. This creates a unified workflow in which each institution contributes according to its mandate, reducing program fragmentation and ensuring consistency across regions.

The model also aligns with the Ministry of Health's priorities under GERMAS and community nutrition programs, which emphasize balanced diets, reduction of malnutrition, and strengthening of local food systems. By promoting egg and poultry utilization foods that meet affordable nutrient-density criteria CRESCOVA enhances practical implementation of these guidelines. It provides an applied, community-friendly approach that complements existing health promotion strategies, making national recommendations more actionable at the household level.

Table 2. CRESCOVA contributes to several Sustainable Development Goals (SDGs)

SDGs	Descriptions
SDG 2 Zero Hunger	through improved access to animal-source foods, household food security, and nutritional education
SDG 3 Good Health and Well-Being	via stunting reduction and dietary improvement
SDG 4 Quality Education	by integrating nutrition–agriculture modules into school systems, encouraging experiential learning;
SDG 5 Gender Equality	by strengthening women's empowerment in livestock management and nutrition decision-making;
SDG 17 Partnerships for the Goals)	through coordinated cross-sector collaboration and knowledge-sharing networks

Policy evidence shows that nutrition-sensitive agriculture becomes impactful when it is supported by education and strong governance (World Bank, 2023b). CRESCOVA addresses this by embedding community involvement, capacity building, and institutional alignment. Its participatory design encourages local leadership, strengthens accountability mechanisms, and supports continuous monitoring. Moreover, the framework offers a concrete pathway for local governments to translate national policy into measurable community-level action, bridging the long-standing gap between evidence and implementation. By aligning scientific insight with real-world program design, CRESCOVA enhances Indonesia's potential to achieve sustainable, long-term reductions in stunting prevalence.

3.8 Opportunities for scaling and future directions

Future opportunities for expanding the CRESCOVA model lie in its flexibility and adaptability to diverse regional contexts. One key direction is integration into school curricula, where agriculture–nutrition modules can support early education on food systems and healthy diets. Evidence shows that school-based programs influence not only students but also family members through knowledge transfer. Embedding poultry-based learning into extracurricular activities, science lessons, or project-based assignments will encourage experiential learning and nurture a new generation that understands the value of animal-source foods for health and sustainable food systems.

Digital transformation also presents significant potential. Online modules, mobile apps, and virtual training can help disseminate poultry and nutrition education widely, even in remote areas. These platforms can also deliver interactive materials, games, quizzes, and video demonstrations that enhance retention and engagement. Furthermore, digital dashboards can be used for real-time monitoring of egg production, dietary intake, and program outcomes, supporting data-driven decision-making at both household and institutional levels. This allows local governments to conduct timely evaluations and respond quickly to emerging challenges.

Scaling efforts should also leverage partnerships with universities, agricultural polytechnics, NGOs, and farmer cooperatives. These institutions can provide technical training, student service programs, research collaboration, and community facilitation ensuring that the model is continually refined and adapted. University-led community engagement (KKN/PKL) offers a sustainable pathway to expand CRESCOVA implementation while fostering innovation through student-led projects.

Another opportunity lies in linking CRESCOVA with microenterprise and village economic programs. Household poultry production can generate additional income, enabling families to reinvest in nutrition, education, and health. Women's groups, youth organizations, and farmer cooperatives can play central roles in sustaining these initiatives by managing collective poultry units, processing eggs, or marketing value-added products such as salted eggs or ready-to-cook chicken. This reinforces both economic resilience and community ownership.

Finally, future research should focus on field testing the model, evaluating effectiveness, conducting cost-benefit analyses, and identifying regional adaptations.

Longitudinal studies can help measure the long-term impact of poultry-based nutrition education on child growth, dietary diversity, behavior change, and household resilience. Through these directions, CRESCOVA can evolve into a nationally recognized model for improving public health, strengthening local food systems, and advancing community empowerment across Indonesia.

4. Conclusions

This study synthesizes multidisciplinary evidence from public health, nutrition, agriculture, and community education to develop the CRESCOVA framework as an innovative model for reducing stunting in Indonesia. By integrating nutrition literacy, poultry-based learning, and community empowerment, CRESCOVA addresses the multifactorial determinants of child growth while supporting household food security. The review demonstrates that eggs and poultry affordable, nutrient-dense, and widely acceptable across Indonesian communities play a critical role in improving linear growth and dietary diversity. However, their potential has not been fully utilized within national nutrition strategies, largely due to fragmentation between sectors and the absence of an operational community-level model. CRESCOVA provides a structured and context-appropriate solution to this gap.

The findings highlight that effective stunting prevention requires more than isolated interventions. Educational programs alone are insufficient without practical demonstrations, while agricultural initiatives rarely impact nutrition outcomes without caregiver behavior change. CRESCOVA bridges these limitations by linking hands-on poultry activities with structured nutrition education and participatory community learning. This integration not only strengthens nutrition knowledge but also enhances household capacity, promotes women's involvement, and encourages sustainable livelihood practices. The model's alignment with the national stunting roadmap, GERMAS, and global frameworks such as SDG 2 and SDG 3 further strengthens its policy relevance and implementation potential.

Despite its strengths, several challenges must be acknowledged. Resource limitations, cultural misconceptions related to egg consumption, coordination gaps between sectors, and unequal access to poultry inputs may hinder real-world adoption. Successful implementation will require supportive local governance, consistent training, strong cross-sector collaboration, and mechanisms to ensure equitable access to poultry resources. Addressing these challenges is essential to ensure that CRESCOVA can be applied in diverse settings, from rural to peri-urban communities, and across provinces with varying economic and geographic conditions.

Overall, CRESCOVA offers a scalable, evidence-based framework capable of transforming how communities engage with nutrition-sensitive agriculture. By positioning poultry and eggs as educational entry points, the model provides both nutritional and economic benefits, supports behavioral change, and fosters community resilience. With continued research, field testing, and multi-stakeholder partnerships, CRESCOVA has the potential to make substantial contributions to Indonesia's long-term goals for human capital development and stunting reduction. The integration of scientific evidence, practical learning, and community empowerment places CRESCOVA as a promising pathway for achieving balanced nutrition and sustainable development at the household and national levels.

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Author Contribution

Conceptualization, D.H.N., N.I.K.P., and S.I.; Methodology, D.H.N. and R.R.R.; Formal Analysis, D.H.N.; Writing – Original Draft Preparation, D.H.N. and N.I.K.P.; Writing – Review & Editing, R.R.R.; Visualization, D.H.N.; Supervision, R.R.R. All authors have read and agreed to the published version of the manuscript.T.

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Conflicts of Interest

The authors declare no conflict of interest.

Declaration of Generative AI Use

During the preparation of this work, the authors used ChatGPT (OpenAI) to assist in translating and refining the English grammar of the manuscript from its original Indonesian version. After using this tool, the authors reviewed and verified all content to ensure the accuracy, integrity, and originality of the final version. The authors take full responsibility for the content of this publication.

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