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Understanding Stunting Determinants in Urban Indonesia: Evidence from the Regional Technical Implementation Unit of Sekaran Public Health Center

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Abstract
As of August 2023, a total of 39 stunting cases were recorded in the service area of Sekaran Public Health Center RTIU, covering five sub-districts. This study aims to analyze the risk factors contributing to the occurrence of stunting in the designated area. Employing a qualitative descriptive design, the study gathered in-depth data through semi-structured interviews and field observations, involving eight purposively selected families with stunted children. Data collection was complemented by triangulation with community health workers and Posyandu cadres. Thematic analysis, following Braun and Clarke's six-phase model, was used to identify emerging patterns and themes. The findings indicate that environmental conditions such as sanitation, toilet facilities, clean water sources, drainage systems, and housing floors were generally adequate. However, many mothers had a history of anemia and received only basic antenatal care, often from private providers. After childbirth, exclusive breastfeeding was rarely practiced, and children were frequently spoon-fed less than three times daily. This suboptimal nutritional intake was primarily due to the parents' work demands and the delegation of caregiving responsibilities to grandmothers or nannies. Additionally, the performance of the Integrated Health Service (Posyandu) in the area was limited to weighing and height measurement activities, without substantial educational or follow-up components. The results of this study imply that interventions to reduce stunting must extend beyond infrastructure and include behavioral changes in nutrition and caregiving practices. The limitation of this study lies in the small number of participants and its localized focus, which may not fully represent broader demographic variations. Future research is recommended to include larger and more diverse samples to enhance the generalizability of findings and explore the effectiveness of integrated, community-based interventions.

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Introduction

Stunting is a chronic nutritional problem caused by prolonged inadequate nutrient intake, which adversely affects children's growth. The World Health Organization (WHO) defines stunting as impaired growth and development resulting from poor nutrition, recurrent infections, and inadequate psychosocial stimulation (Das et al., 2020; World Health Organization, 2022). It represents long-term malnutrition that occurs when children fail to reach their linear growth potential, resulting in irreversible cognitive and physical impairments (Ademas et al., 2021). Stunting is identified by measuring a child's height or length and comparing it with standardized values according to age and sex (Christian et al., 2023). Chowdhury et al. (2022) also describe stunting as delayed linear growth in children. The consequences of stunting include chronic diseases, reduced learning capacity, and even mental retardation, all of which can hinder a nation's development and global competitiveness.

Efforts to improve human capital and national competitiveness have involved allocating government resources to compulsory education, which significantly influences children's health and academic achievement from an early age (Dalaba et al., 2021; Yang et al., 2022). Karan et al. (2023) and Diamond-Smith et al. (2022) further emphasize that health sector investment can lead to job creation, increased labor productivity, and economic growth. Therefore, addressing stunting requires a collaborative approach involving various ministries and stakeholders to prevent its long-term impact on national development.

Numerous studies have examined the causes of stunting. Aiga et al. (2019) identified age and household size as contributing factors. Amiri et al. (2019) found a positive correlation between adolescent age and stunting prevalence. Woldesenbet et al. (2023) highlighted poor sanitation—including open defecation—as a significant threat to public health and a contributor to childhood stunting in developing countries. Other factors, including gender, birth order, exclusive breastfeeding, family economic status, household structure, acute diarrhea, and maternal education, also influence children's nutritional status and contribute to stunting and underweight conditions (Murarkar et al., 2020). Tesfaye and Egata (2022) found statistically significant relationships between stunting and maternal education, decision-making power, hygiene practices, agro-ecological conditions, antenatal care, exclusive breastfeeding, dietary diversity, childhood illness, and the child's age and gender.

In terms of intervention strategies, experts have explored various nutrition programs implemented at home, in schools, and in workplaces. Kairiza et al. (2020) recommended that policymakers promote food fortification and biofortification programs to support stunting reduction. Mistry et al. (2019) showed that face-to-face nutrition counseling by community health workers significantly improved maternal knowledge and child feeding practices. The success of these interventions depends on effective coordination and communication among stakeholders. A multisectoral approach with program convergence across all levels is essential for stunting prevention (Kemendikbud, 2019). The Ministry of National Land Agency emphasized that integrated action—through coordinated activities—is vital for improving the delivery of nutrition interventions aimed at preventing and reducing stunting. This requires changes in cross-sectoral behavior and program implementation to ensure accessibility for target families, especially those within the First 1,000 Days of Life (1,000 HPK) framework (Bappenas, 2019).

Regulations, technical manuals, and intervention guidebooks have played a crucial role in accelerating stunting reduction in Indonesia. Despite these efforts, stunting prevalence remains relatively high. According to monitoring data from the Directorate General of Regional Development, Ministry of Home Affairs, the prevalence of stunting in Central Java in 2022 was 9.4%, which is above the national average of 8.4% among 15,798,153 children under five. In Semarang City, the prevalence was 3.15%, lower than the provincial average but higher than that of Surakarta City, which was 1.9% (Ditjen Bina Pembangunan Daerah, 2023). Data from the Semarang City Health Office showed that as of February 2023, the prevalence had decreased to 13.40%, although this remained higher than the 12.92% recorded in July 2022 (Semarang, 2023).

Further analysis of 2022 monitoring data revealed that all sub-districts under the jurisdiction of the Sekaran Regional Technical Implementation Unit (RTIU) Public Health Center reported stunting prevalence rates above the city average of 3.2%. Specifically, prevalence was as follows: Sekaran (6.8%), Patemon (1.6%), Sukorejo (5.5%), Kalisegoro (3.9%), and Ngijo (4.2%) (Ditjen Bina Pembangunan Daerah, 2023).

The Sekaran Public Health Center is located near the Semarang State University (UNNES), which is tasked with contributing to stunting reduction as outlined in Presidential Regulation No. 72 of 2021. This national strategy emphasizes five pillars, including strengthening systems, data, research, and innovation. Universities are expected to participate actively by producing and applying research innovations (Perpres No. 72 Tahun 2021 Tentang Percepatan Penurunan Stunting, 2021). However, based on the current stunting data in the Sekaran Public Health Center's service area, the visible involvement of UNNES remains limited. To date, no in-depth

studies have specifically analyzed the risk factors for stunting in this area, especially those that could inform and enhance the university's engagement. Therefore, this study aims to analyze the risk factors contributing to stunting within the RTIU of Sekaran Public Health Center in 2023. The results are expected to identify key contributing factors and serve as a foundation for UNNES to expand its research and community outreach efforts in underserved areas.

Methods

Research Design

This study employed a qualitative descriptive design to explore and understand the risk factors associated with stunting as experienced by families in the Sekaran Public Health Center service area. The research focused on obtaining in-depth insights through qualitative data collection methods, including interviews and field observations(Creswell & Creswell, 2018). The design was chosen to allow a rich and contextual interpretation of the stunting phenomenon in its real-life setting.

Participants and Sampling Strategy

Participants consisted of eight families selected purposively from the total of thirty-nine families identified as having children with stunting in the service area. The selection was based on the inclusion criteria, namely: (1) having a child aged 0–59 months diagnosed with stunting, (2) living in the working area of Sekaran Health Center for at least one year, and (3) willing to participate in the study voluntarily. Ethical considerations were observed through informed consent and ensuring the right to withdraw without consequence. When a selected participant declined, a substitute was recruited with matching criteria. Participants were informed of the research objectives, procedures, benefits, and risks. Informed consent was obtained in writing, and all data were anonymized to protect confidentiality.

Data Collection Techniques

Primary data were obtained through in-depth semi-structured interviews conducted with parents of stunted children. To ensure consistency across interviews, an interview guide with open-ended questions was used. Each session lasted approximately 45–60 minutes and was conducted at the participants' homes to ensure comfort and contextual understanding. Triangulation was applied by including Posyandu cadres and community health workers (Puskesmas officers) as secondary informants. Observations were also carried out to document home sanitation, clean water access, and caregiving practices. An observation checklist was used to standardize the collected data, covering variables such as parental occupation, income, and household hygiene.

Data Analysis Procedure

Thematic analysis was used to identify patterns and categories emerging from the data. The analytic process followed Braun and Clarke's (2006) six-phase model: (1) familiarization with the data, (2) generation of initial codes, (3) search for themes, (4) review of themes, (5) defining and naming themes, and (6) producing the final report. Manual coding was carried out independently by two researchers, followed by comparison and consolidation through discussion. Discrepancies were resolved by consensus.

Trustworthiness and Validation

To ensure credibility, triangulation of sources was implemented by comparing data from parents, health workers, and Posyandu cadres. Member checking was conducted by summarizing the findings and returning them to participants for confirmation. Dependability was strengthened through audit trails and documentation of decisions throughout the research process. Reflexivity was maintained by documenting the researcher's assumptions, role, and potential biases.

Result

Research Location Overview

A Public Health Center (Puskesmas) is a health service facility that provides both public health programs and primary individual health services, with a greater emphasis on promotive and preventive efforts (26). Sekaran Public Health Center is one of 38 Regional Technical Implementation Units (RTIUs) under the Semarang City Health Office. It is located at Jl. Rambutan No. 44, Sekaran Village. The center's service area spans 1,897.630 km^{2} and serves a population of 24,276 people. It is bordered by the Pegandan Public Health Center to the north, the Gunungpati Public Health Center to the south and west, and the Ngesrep Public Health Center to the east. The service area includes Sekaran Village, Sukorejo Village, Patemon Village, Ngijo Village, and Kalisegoro Village.

Risk Factors for Stunting in the Service Area of Sekaran Public Health Center

Stunting remains a major obstacle to human resource development due to its long-term effects on adult economic productivity. Environmental and family health factors—including adolescent health, parental health, antenatal and postnatal care (such as exclusive breastfeeding, parenting practices, and family income), as well as community-based preventive efforts like Integrated Health Services—are among the key risk factors. If not properly addressed, these factors can contribute to an increase in stunting prevalence, including in the service area of Sekaran Public Health Center, Semarang City. As of August 2023, the center recorded 39 cases of stunted children spread across the five sub-districts in its service area.

Family Environment

Observational data collected by the researchers show that 90% of families with stunted children use artesian wells as their primary source of water for daily activities such as bathing, cooking, and washing. The remaining 10% rely on water from the Regional Drinking Water Company (PDAM). Housing conditions were found to be relatively adequate, with all households (100%) using ceramic tile flooring and having access to private toilets.

Family Health

Adolescent health, marriage preparation, and maternal health during pregnancy are critical periods that influence child health outcomes. Maintaining a healthy lifestyle and balanced diet during adolescence is important to prevent intergenerational health issues. Interviews with mothers of stunted children provided the following insights:

> ``*I don't have a serious health history. Thank God, I've only had flu, coughs, and colds. My blood pressure has always been normal, even since adolescence*'' (IU1).
>
> ``*My husband and I have never had any health problems. Our blood sugar and blood pressure are normal*'' (IU4).

However, contrasting accounts were provided by others:

> ``*I've never had a major illness, but I do have low blood pressure and anemia. I've had low blood pressure since junior high school*'' (IU2).
>
> ``*I have low blood pressure, and my husband has high blood pressure. My parents also have low blood pressure*'' (IU5).
>
> ``*Our field visits revealed several parents with anemia. We then investigated the condition of adolescent girls in the area and found a surprisingly high incidence of anemia. Without timely intervention, these young women may be at increased risk of giving birth to stunted children in the future*'' (IT1).

Health conditions of parents, particularly during adolescence, vary widely, with several mothers reporting histories of anemia and low blood pressure. These maternal health issues, if not addressed early, can increase the risk of intergenerational stunting. The presence of anemia among adolescent girls further underlines the importance of early interventions targeting female youth. Such health patterns suggest a critical need for strengthening adolescent health programs in the area.

Pregnancy Period

Pregnancy is a crucial period that significantly affects maternal and fetal health. The following insights were obtained through in-depth interviews:

``*During pregnancy, thank God, everything went smoothly because I regularly visited a doctor. I ate three meals a day as usual. After each check-up, the doctor would prescribe medicine, which I picked up at the pharmacy*'' (IU2).

``*I never received any formal guidance or training on health during pregnancy. The doctor only gave some general advice to help ensure a healthy pregnancy and delivery''*(IU7).

``*I ate as usual during pregnancy. Since it was my first time, I often read books and browsed websites for information about pregnancy*'' (IU8).

Health workers also shared relevant observations:

``*Mothers of stunted children typically did not attend Integrated Health Services during pregnancy because they chose to consult private doctors instead*'' (IT1).

``*This area is classified as urban, so it is rare for pregnant women to visit the Public Health Center. Most prefer to go to private doctors, including those whose children are stunted*'' (IT2).

Most mothers reported accessing antenatal care through private doctors, often neglecting Integrated Health Services. Although basic pregnancy care such as regular check-ups and nutrition appears adequate, formal health education and structured guidance were lacking. This pattern reflects a gap in health system integration and missed opportunities for preventive education during pregnancy. Strengthening institutional collaboration could improve maternal and fetal outcomes.

Postpartum

Exclusive Breastfeeding

Previous studies have produced mixed findings regarding the relationship between breastfeeding practices and the prevalence of stunting. Some research indicates higher rates of mild and severe malnutrition among breastfed children. The results of in-depth interviews with families of stunted children revealed the following insights:

``*I breastfed my child until he was two years old. However, I also gave formula milk because my breast milk wasn't enough—my child still seemed hungry*'' (IU8).

``*I know about exclusive breastfeeding, Sir… I wanted to do it, but I couldn't. It's difficult, and sometimes my nipples hurt when breastfeeding… so I added formula milk*'' (IU3).

``*I had problems with my breast milk—it didn't come out—so I used formula milk instead''* (IU2).

` `*It's rare, almost no one exclusively breastfeeds here… some have to work, others say they can't wait to breastfeed, or have low milk supply*'' (IT2).

Exclusive breastfeeding practices were found to be minimal among respondents, mainly due to insufficient milk supply, pain during breastfeeding, or work-related constraints. Most mothers supplemented with formula, and health workers observed a general lack of exclusive breastfeeding in the area. These findings point to the need for targeted breastfeeding support and counseling, especially for working mothers.

Parenting and Economics

Stunting in urban areas is often influenced by parenting styles and economic pressures. Feeding practices are particularly challenging for middle-income families where both parents work full time. Interview findings from families with stunted children are summarized as follows:

``*I feed my child three times a day… I spoon-feed him in the morning and evening. At noon, he's with his grandmother—she feeds him because I have to work. Sometimes he eats easily, sometimes he refuses. If he isn't in the mood, he might only eat three or four spoonfuls. I always include vegetables and side dishes, and occasionally bananas… but my child has a poor appetite*'' (IU2).

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``*My child eats three times a day with vegetables and side dishes. He eats with his nanny, but I also spoon-feed him sometimes. Still, I get impatient, so he seems more comfortable with his nanny*'' (IU5).

`` *I work, Sir… so every day my child stays with his grandmother, including during meals. I usually help with dinner if he hasn't eaten yet*'' (IU7).

``*In the Sekaran Public Health Center area, most stunted children are cared for by grandmothers or nannies. During field visits, I noticed many cases where children were not fed properly—like missing breakfast and only being given milk. That means some children eat only twice a day. Also, some children have poor appetites and drink more than they eat, leading to satiety without sufficient nutrients*'' (IT1).

Feeding practices are heavily influenced by economic demands, with many children cared for by grandmothers or nannies during the day. Meals are often irregular or insufficient, and feeding is sometimes skipped or replaced with milk due to poor appetite. These inconsistent practices highlight how economic pressure and caregiver dynamics contribute to nutritional inadequacy. Parental education on responsive feeding could be a key intervention.

Integrated Health Service

Access to health services provided by the private sector, communities, and the government is critical in determining health outcomes. Quality, affordable services play a preventive and curative role in reducing stunting. Interviews with families of stunted children, Integrated Health Service staff, Public Health Center officers, and village officials yielded the following information:

``E*very month, I bring my child to the Integrated Health Service to be weighed until he turns two. After the weighing, food is usually provided*'' (IU1).

`` *There's monthly weighing at the Integrated Health Service, and the results are recorded. If there's a problem, I usually receive advice and encouragement*'' (IU6).

`` *Yes, we conduct monthly weighing sessions and require all families with toddlers to participate. After the weighing, food is provided. If some mothers don't show up, we visit their homes and encourage them to come in. If a child's growth chart is in the red or near the red line, we immediately advise the mother and report it during village office meetings. The Public Health Center will then follow up*'' (IT2).

``*The Integrated Health Service conducts monthly weight measurements. These are reported to us at regular village meetings. If there's a stunting case, we at the Public Health Center perform further screening to confirm whether the child is truly stunted*'' (IT1).

`` *Here in the sub-district, every month there's an Integrated Health Service meeting where staff report on their activities and child development monitoring*'' (IT3).

The Integrated Health Service (Posyandu) plays a significant role in monitoring child growth through regular weighing and follow-up. The system includes home visits and village-level coordination, making it a strong platform for early detection. However, consistent participation and responsiveness vary among families. Optimizing community engagement could enhance the impact of this service in stunting prevention.

Discussion

This study identifies multiple interrelated factors contributing to the persistence of stunting among children in the service area of Sekaran Public Health Center. These include environmental conditions, maternal and adolescent health, pregnancy care, postnatal practices such as exclusive breastfeeding, family economic conditions, parenting patterns, and the role of Integrated Health Services (Posyandu). Each of these elements, when inadequately addressed, may significantly elevate the risk of stunting in early childhood. The discussion below synthesizes the empirical findings with existing literature, highlighting critical gaps and potential intervention areas. The analysis also considers the implications for local policy, health service delivery, and parental education strategies.

The findings underscore the complexity of stunting as a multidimensional issue rooted in both structural and behavioral determinants. While several contributing factors were observed,

some were more prominent in their impact and frequency among participants. This analysis provides a nuanced understanding of how micro-level practices interact with broader systems, such as public health services and socio-economic constraints. Thus, understanding these risk factors in a contextualized manner is essential to developing targeted, effective stunting reduction strategies at the community level. The sections below elaborate on each major domain.

Family Environment and Sanitation

The results show that most families had access to adequate sanitation facilities, including toilets and clean water sources. House floors were all ceramic, and a significant portion used artesian wells or piped water, suggesting that, in general, sanitation infrastructure is relatively well-developed. Nevertheless, the role of environmental sanitation should not be underestimated, as poor hygiene and water quality have been linked to stunting in other contexts (Ademas et al., 2021). While this study suggests sanitation was not a major contributing factor, it remains a latent risk when not monitored regularly. Subtle variations in hygiene behavior, water storage, and waste management might still influence children's health.

It is important to note that even in families with proper infrastructure, sanitation-related practices such as handwashing, water boiling, and food hygiene were not deeply explored. In line with Ademas et al. (2021), safe sanitation is not only about facilities but also about consistent hygienic behavior that separates human waste from contact with humans. Therefore, environmental interventions should not be excluded from policy focus simply because of infrastructure adequacy. Public health programs need to reinforce behavior change components related to hygiene, which are often overlooked. Consequently, while not the main factor in this study, environmental conditions remain part of the complex interplay influencing child nutrition outcomes.

Maternal and Adolescent Health

One of the consistent findings in this study was that many mothers of stunted children reported having experienced anemia or low blood pressure since adolescence. This aligns with evidence that poor adolescent health—particularly iron-deficiency anemia—has long-term implications for maternal and child health (Aras Utami, Ani Margawati, Dodik Pramono, 2021). Adolescent girls who enter pregnancy with suboptimal health are at increased risk of giving birth to babies with low birth weight and stunted growth. The intergenerational impact of maternal health underlines the need for reproductive health interventions beginning early in life. Preventive strategies should include screening and treating anemia during school years, especially in areas with known high stunting prevalence.

Furthermore, research by Shifti et al. (2022) supports the assertion that maternal anemia and suboptimal birth size mediate the association between short birth intervals and undernutrition. Policies targeting adolescent girls must be complemented by community-wide efforts to delay early pregnancies and support comprehensive antenatal care. Efforts should also focus on improving nutrition literacy among young women, particularly those from low-income families. Enhancing maternal health literacy will empower women to make informed decisions before and during pregnancy. As such, adolescent health represents a foundational investment in reducing stunting prevalence across generations (Kumar et al., 2021; Sk et al., 2021).

Pregnancy Care

Findings indicate that most mothers accessed antenatal care through doctors or midwives, either in government facilities or private clinics. They reported routine prenatal checkups and moderate attention to diet, which meets the minimal standards of maternal care. However, deeper examination reveals the lack of structured health education during antenatal visits, especially regarding nutrition and newborn care. According to Susanti & Ulpawati (2020), standardized antenatal care includes not just physical checkups but also educational counseling and early detection of risks. In the absence of such interventions, the mere fulfillment of visit frequency cannot be equated with quality care.

Complementary findings from Permatasari et al. (2021) and Dhaded et al. (2020) show that antenatal education and community-level counseling improve pregnancy outcomes and reduce stunting rates. Additionally, behavioral barriers to iron supplementation and healthcare-seeking need to be addressed through community-based education (Traore et al., 2023). The presence of adequate antenatal services must therefore be coupled with meaningful interaction, follow-up, and personalized advice. Government health programs must institutionalize continuous engagement with pregnant women to sustain knowledge retention and behavior change. Consequently, while pregnancy care appeared sufficient in quantity, it lacked qualitative impact in the study context.

Postnatal Period and Exclusive Breastfeeding

The first 1,000 days of life, particularly from birth to 24 months, are critical for physical and cognitive development. This study confirms that postnatal care practices, especially exclusive breastfeeding, were suboptimal among most participants. Many mothers cited insufficient milk production, work obligations, or pain during breastfeeding as barriers, leading to early use of formula milk. These practices are detrimental, as exclusive breastfeeding significantly reduces the risk of infections and promotes optimal growth (Kementerian Kesehatan RI, 2012; Dake et al., 2019). The lack of workplace lactation facilities also restricts mothers' ability to breastfeed effectively.

Studies have shown mixed findings regarding the relationship between breastfeeding and stunting. For example, Tello et al. (2022) note no direct association in some contexts, yet the importance of achieving minimum meal frequency after six months remains critical. Luzingu et al. (2022) and Güneş et al. (2023) further emphasize how improper complementary feeding increases the risk of wasting and stunting. Hence, both breastfeeding and post-six-month nutrition practices need to be considered together. Strategies such as breastfeeding support groups, workplace policies for lactating mothers, and nutritional counseling are essential to optimize early child nutrition. Without systemic support, exclusive breastfeeding practices will remain difficult for many families.

Parenting and Economic Conditions

Economic pressure and inadequate caregiving practices emerged as significant factors contributing to stunting. Many children were cared for by grandparents or nannies while mothers worked, which disrupted consistent feeding and supervision. Although maternal employment can enhance household income, it often compromises caregiving quality in nuclear families (Win et al., 2022). Some children reportedly ate only twice a day or skipped meals altogether, which aligns with findings by Sisay et al. (2022) that lower meal frequency is associated with higher risk of stunting and thinness. The delegation of childcare without adequate training for substitute caregivers may further weaken nutrition outcomes.

Additionally, high parental stress, limited understanding of child nutrition, and authoritarian or neglectful parenting styles exacerbate the problem. Studies have shown that stress-induced parenting correlates with coercive feeding, poor child appetite, and selective eating behaviors (Berge et al., 2023; Jang et al., 2021). Interventions promoting responsive feeding, emotional support, and structural parenting strategies have shown better outcomes (Thomson et al., 2020). Therefore, stunting prevention requires not only nutritional interventions but also psychosocial and parenting education programs. Empowering caregivers, particularly those involved in daily childcare, with practical knowledge is essential (Adebiyi et al., 2022). This highlights the multidimensional nature of stunting beyond economics.

Integrated Health Services (Posyandu)

The study found that community participation in Integrated Health Services (Posyandu) was relatively high, particularly in routine child weighing and growth monitoring. However, these services were limited to anthropometric measurements and provision of supplemental food, without comprehensive health education or individualized counseling. According to official

guidelines, Posyandu services should include immunization, growth status analysis, health checks, and early developmental screening (Kemenkes RI, 2011). Yet, such holistic services were largely absent in this context. The lack of counseling represents a missed opportunity to intervene early in malnutrition trajectories.

Effective health promotion should not only inform but also change behavior. Mistry et al. (2019) emphasized the importance of training Community Health Workers (CHWs) to provide consistent nutrition education to mothers. In line with this, Faza et al. (2022) and Gladis Alfioni & Mukminin (2024) advocate for the integration of health promotion with early childhood education at the community level. The absence of routine Puskesmas engagement in PAUD institutions—due to children being above two years—shows a policy gap that undermines long-term prevention efforts. As stunting can persist or worsen after infancy, health programs must expand their target age range. Strengthening the role of Posyandu and linking it to PAUD is a strategic necessity.

Policy Implications

Based on these findings, several policy recommendations emerge. First, there is a need for intensified antenatal and postnatal education focusing on nutrition, breastfeeding, and responsive parenting. Second, regulations mandating lactation-friendly workplace environments must be enforced. Third, cross-sector collaboration is needed to ensure Puskesmas and early education institutions jointly address child development and stunting risks. Without institutional coordination, many families fall through the cracks of fragmented service delivery. Addressing these systemic gaps is critical to achieving stunting reduction targets.

Moreover, health promotion should shift from general information provision to targeted interventions tailored to family conditions. This includes identifying at-risk mothers during pregnancy and maintaining consistent follow-up throughout early childhood. Community-based monitoring systems and behavior-change communication strategies should be institutionalized. Finally, integrating health, education, and social protection programs will produce a synergistic effect on child nutrition outcomes. In sum, addressing stunting requires a holistic, life-course, and community-embedded approach.

Conclusion

This study aimed to analyze the risk factors that contribute to the persistence of stunting among children in the service area of Sekaran Public Health Center, Semarang City. The findings show that while environmental factors such as sanitation, toilet access, and water quality are generally adequate, stunting still occurs due to deeper behavioral and systemic issues. Notably, maternal health history—particularly adolescent anemia—remains a critical contributing factor. Pregnancy care is mostly in accordance with standards; however, it lacks nutritional education and behavioral support. The most dominant postnatal contributors to stunting are the absence of exclusive breastfeeding, low feeding frequency, and inconsistent parenting, which are largely driven by parental work obligations and insufficient caregiver supervision.

In addition, the Integrated Health Service (Posyandu) has not performed optimally in its preventive and educational roles. Although physical growth monitoring is conducted routinely, there is a lack of personalized counseling, nutritional support, and community-based follow-up—especially in early childhood education centers. These gaps highlight the need for multi-sectoral collaboration between health institutions, education centers (PAUD), and employers to support mothers in breastfeeding and child care. Policies should focus on strengthening adolescent health education, enhancing support for breastfeeding working mothers, and expanding the scope of Posyandu services. Future research is needed to explore intervention effectiveness and caregiver dynamics using a broader and more diverse population sample. Overall, tackling stunting requires an integrated, behavioral, and systemic approach across the continuum of care.

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Declarations

Author contribution statement

Amirul Mukminin was responsible for conceptualization, data collection, data verification, data analysis, report writing, and drafting the article. Reni Pawestuti Ambari Sumanto contributed to data collection, data verification, data analysis, and report writing. Tutuk Wijayantiningrum served as the field facilitator.

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Data availability statement

The research data are available in the 2023 research report of the Faculty of Education and Psychology (FIPP), Semarang State University (UNNES).

Declaration of interests statement

The authors declare no competing interests that could have influenced the results presented in this article.

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