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The Relationship Between Antenatal Care (ANC) History and the Incidence of Stunting Among Toddlers Aged 24–59 Months in the Service Area of the Godong 1 Community Health Center

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Abstract

Stunting is a chronic linear growth disorder in children that may begin during pregnancy and is influenced by maternal and environmental factors. Antenatal Care (ANC) plays an important role in stunting prevention through monitoring maternal and fetal health, detecting pregnancy risk factors, providing supplementation, and delivering health education. This study aimed to analyze the relationship between maternal ANC history and stunting incidence among toddlers aged 24–59 months in the service area of Godong 1 Community Health Center in 2025. An analytic observational study with a cross-sectional design was conducted among 183 mothers with toddlers aged 24–59 months, with the sample size determined using the Slovin formula. ANC history was assessed based on the number and timing of visits and the completeness of documented ANC service components in the Maternal and Child Health Book or medical records. Data were collected using an observation sheet and analyzed through univariate and bivariate analyses using the Chi-Square test. A total of 125 respondents (68.3%) had a good ANC history, while 58 (31.7%) had an inadequate ANC history. Stunting was identified in 133 toddlers (72.7%). Among mothers with inadequate ANC histories, 55 toddlers (94.8%) experienced stunting, compared with 78 toddlers (62.4%) among those with good ANC histories. The Chi-Square test demonstrated a significant relationship between ANC history and stunting ($p < 0.001$; $X^2 = 20.980$), with an odds ratio of 11.047. Inadequate ANC history was associated with approximately 11-fold higher odds of stunting. Optimizing the frequency, timing, and completeness of ANC services is essential for strengthening stunting prevention from pregnancy.

Keywords: Age 24–59 Months, ANC History, Antenatal Care, Stunting, Toddlers.



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INTRODUCTION

Child growth and development constitute important indicators of population health and reflect the broader quality of human resources within a country (Idris et al., 2024). Indonesia continues to face persistent nutritional problems that may generate long-term consequences for physical development, cognitive capacity, and future productivity, particularly among children exposed to inadequate nutrition during critical periods of growth (Dewi et al., 2025). Among these challenges, stunting remains a major global and national public health concern because impaired linear growth reflects the cumulative consequences of nutritional deprivation, recurrent infection, and unfavorable environmental and caregiving conditions (Marlina et al., 2022). Stunting is conventionally defined as a height-for-age or length-for-age z-score below -2 standard deviations from the median of the WHO Child Growth Standards, providing an internationally comparable indicator of chronic growth restriction (Rahimi et al., 2024). The condition extends beyond impaired physical stature because persistent growth restriction is associated with adverse consequences for brain development, metabolic function, immune competence, and health trajectories extending into adulthood (Soliman et al., 2021). Contemporary evidence increasingly conceptualizes stunting as a life-course condition whose determinants begin during pregnancy and accumulate throughout infancy and early childhood (Katoch, 2022). This perspective places maternal health and antenatal care within the upstream determinants of child growth because pregnancy represents a critical period in which nutritional, biological, and healthcare-related risks can be identified and addressed before they influence subsequent development.

The global burden of stunting remains substantial despite improvements in child nutrition, with approximately 23.2% or 150.2 million children under five years affected in 2024, demonstrating that

progress has not eliminated the structural determinants of chronic growth restriction (Mostafa et al., 2024). Southeast Asia has experienced a considerable decline in stunting prevalence, yet the persistence of a substantial burden toward 2030 indicates that reductions in prevalence have not been sufficient to achieve elimination (Mostafa et al., 2024). Indonesia recorded a national stunting prevalence of 19.8% in 2024, indicating that approximately one in five children remained affected despite continuing national nutrition interventions (Lestari et al., 2025). Central Java reported a prevalence of 17.1% during the same period, demonstrating that the provincial burden remains clinically and epidemiologically relevant even though it is below the national estimate (Kemenkes RI, 2025b). Spatial analysis has demonstrated that stunting in Central Java is unevenly distributed across geographical areas, supporting the need to investigate determinants at localized levels rather than relying exclusively on national or provincial indicators (Devi et al., 2025). In Grobogan Regency, the prevalence reached 17% in 2024, placing the area among regions requiring sustained attention to persistent childhood undernutrition (Dinkes. Provinsi Jawa Tengah, 2025). Within the service area of the Godong 1 Community Health Center, 221 toddlers were recorded as stunted in 2024, exceeding the number of wasting cases and increasing from 219 cases in 2023, which establishes a strong local epidemiological basis for investigating potentially modifiable determinants of stunting.

Stunting develops through interconnected nutritional, biological, infectious, environmental, and socioeconomic pathways, meaning that prenatal conditions cannot be considered independently from circumstances experienced by children after birth. Maternal undernutrition, anemia, and micronutrient deficiencies during pregnancy may compromise fetal growth and increase the probability of adverse birth outcomes that subsequently heighten vulnerability to stunting (WHO, 2020). Evidence from a randomized controlled trial indicates that fortified balanced energy–protein supplementation during pregnancy and lactation can influence infant growth, supporting the biological relevance of maternal nutritional conditions for subsequent growth trajectories (Argaw et al., 2023). Prenatal small-quantity lipid-based nutrient supplementation has also demonstrated benefits for pregnancy, birth, and early infant outcomes, reinforcing the importance of nutritional intervention during gestation as part of early stunting prevention (Dewey et al., 2024). Postnatal dietary quality remains important because animal-source foods provide essential amino acids and other nutrients required for linear growth during early childhood (Parikh et al., 2022). Recurrent infections and parasitic exposure may further interfere with nutrient absorption and increase metabolic demands, creating additional biological pathways toward impaired linear growth (Gabain et al., 2023). Household poverty can intensify these risks by restricting access to nutritious foods, healthcare, sanitation, and appropriate childcare, making childhood stunting a cumulative manifestation of exposures operating across several stages of the life course (Wulandari et al., 2025).

Within this multifactorial pathway, Antenatal Care (ANC) represents an important preventive platform because repeated contact with healthcare providers creates opportunities to identify maternal and fetal risks before they influence later child growth. WHO recommendations conceptualize ANC as comprehensive care encompassing preventive services, health education, nutritional support, and risk assessment rather than merely a mechanism for recording pregnancy visits (Tunçalp et al., 2022). Indonesia has strengthened this approach through a standard requiring at least six ANC contacts during pregnancy, distributed across the first, second, and third trimesters to support continuous monitoring of maternal and fetal conditions (Kemenkes RI, 2025a). The clinical value of repeated antenatal contacts lies in opportunities to detect anemia, nutritional deficiencies, pregnancy complications, fetal growth abnormalities, and other conditions requiring timely intervention (Benjamin et al., 2023). Recent evidence indicates that adherence to recommended ANC contacts, together with appropriate antenatal services, can improve maternal healthcare processes and pregnancy outcomes, although the benefits depend on the timing and content of care rather than frequency alone (Shirin et al., 2025). Indonesian evidence has reported higher stunting prevalence among children whose mothers did not receive routine pregnancy examinations, suggesting that inadequate maternal healthcare utilization may be associated with subsequent growth impairment (Fitriani et al., 2024). These mechanisms suggest that the continuity of maternal healthcare during pregnancy may represent an important pathway through which preventive services influence child growth beyond the immediate pregnancy period.

The existing evidence nevertheless leaves an important empirical gap regarding how ANC history should be interpreted when assessing stunting among children aged 24–59 months. Previous studies have frequently emphasized the number of ANC visits, whereas adequate antenatal care also

depends on whether contacts occur according to the recommended gestational schedule and provide opportunities for appropriate screening, counseling, supplementation, and intervention. Recent Indonesian research has reported an association between ANC visits and stunting among toddlers aged 24–59 months, but differences in study populations, exposure measurements, and contextual characteristics limit direct generalization across settings (Ningsih et al., 2025). Other evidence has identified relationships between ANC history, parenting patterns, and stunting, indicating that maternal healthcare utilization operates within a broader behavioral and nutritional environment rather than functioning as an isolated determinant (Harumi et al., 2025). Research based on Indonesian national survey data has also highlighted the relevance of the quality of pregnancy examinations, suggesting that evaluating ANC solely through visit frequency may overlook important dimensions of maternal healthcare (Audila & Helda, 2025). This issue is particularly relevant in Godong because the near-complete K1 coverage does not correspond to complete ANC utilization, with K4 coverage remaining at 93.37%, indicating that initial access to maternal healthcare has not necessarily translated into sustained antenatal contact. The discrepancy between initial and subsequent ANC coverage creates a locally relevant question regarding whether differences in maternal ANC histories are associated with stunting among toddlers who have already entered the 24–59-month developmental period.

The present study is positioned within a life-course perspective of stunting by examining ANC history as a potentially modifiable prenatal factor associated with growth outcomes during the toddler period. The study specifically focuses on toddlers aged 24–59 months in the service area of the Godong 1 Community Health Center, where the continuing local burden of stunting provides a relevant setting for examining maternal healthcare histories. The central research problem is whether differences in ANC history are associated with the occurrence of stunting among toddlers within this population. This approach recognizes that stunting is produced through interconnected maternal, nutritional, environmental, infectious, and socioeconomic pathways rather than through a single determinant. The study aims to determine the relationship between ANC history and the incidence of stunting among toddlers aged 24–59 months in the service area of the Godong 1 Community Health Center. The findings are expected to provide empirical evidence for strengthening the continuity, timing, and utilization of antenatal services as part of integrated strategies for preventing childhood growth failure at the primary healthcare level. Theoretically, the study contributes to the life-course understanding of stunting by clarifying the potential relationship between prenatal healthcare utilization and later childhood growth, while methodologically it provides context-specific evidence that can inform future research examining ANC history as a component of comprehensive stunting-prevention strategies.

RESEARCH METHODS

This study employed an empirical quantitative research design using an analytic observational approach with a cross-sectional design to examine the relationship between maternal Antenatal Care (ANC) history and the incidence of stunting among toddlers aged 24–59 months in the service area of the Godong 1 Community Health Center. A cross-sectional design was selected because the study assessed ANC history through documented maternal healthcare records and examined its relationship with stunting status within the defined study population (Notoatmodjo, 2018). The participants consisted of 183 mothers who had toddlers aged 24–59 months and resided within the service area of the Godong 1 Community Health Center, with the sample size determined using the Slovin formula. The inclusion criteria comprised mothers with toddlers aged 24–59 months, accessible Buku KIA or relevant medical records containing ANC information, and willingness to participate, whereas mothers whose children's anthropometric records or ANC histories were incomplete or unverifiable were excluded from the study. The data collection procedure involved reviewing Buku KIA and healthcare records to identify the number and timing of ANC visits and the completeness of documented ANC service components, following systematic procedures for quantitative health research (Riyanto & Hatmawan, 2020). A structured observation sheet was used to record maternal characteristics, ANC history, and child growth information, with the instrument designed to ensure consistent extraction of information from documentary sources (Arundel, 2023). ANC history was assessed according to the documented frequency and timing of visits in relation to gestational age, while stunting status was determined from the child's recorded anthropometric measurements based on height-for-age criteria.

Data were subsequently analyzed using univariate analysis to describe the distribution of study variables and bivariate analysis to examine the association between ANC history and stunting. The Chi-

Square test was applied to evaluate the statistical relationship between the categorical exposure and outcome variables, using an appropriate significance level for inferential analysis (Denis, 2020). Statistical procedures were conducted systematically to distinguish descriptive characteristics from inferential findings and to ensure that conclusions were derived from the observed empirical data (Sugiyono, 2025). The use of categorical statistical analysis was aligned with quantitative research principles for examining relationships between variables measured at the nominal or ordinal level (Warne, 2020). The results of the analysis were interpreted based on the observed distribution and statistical significance of the relationship between ANC history and stunting. Ethical approval was obtained from the Bioethics Commission of Universitas Islam Sultan Agung Semarang under approval number 103/II/2026/Komisi Bioetik, while research permission was obtained from the Investment and One-Stop Integrated Services Office of the Government of Grobogan Regency under Number 400.3.2/122/DPMPTSP/2026. The study procedures were implemented in accordance with applicable principles of ethical research involving human participants and the responsible use of health-related records (McNair, 2022).

RESULTS AND DISCUSSION

Antenatal Care (ANC) History Among Mothers

The distribution of antenatal care (ANC) history among the 183 mothers showed that 125 respondents (68.3%) had a good ANC history, while 58 respondents (31.7%) had a poor ANC history. These findings indicate that most mothers had utilized antenatal services according to the criteria applied in this study, although a substantial proportion had not received ANC optimally. ANC history in this study was assessed not only from the number of visits but also from the timing of visits and the completeness of documented ANC service components. The WHO ANC framework emphasizes that effective antenatal care should provide regular contact between pregnant women and health professionals while addressing maternal and fetal health needs throughout pregnancy (Tunçalp et al., 2022). The relatively higher proportion of good ANC history suggests that maternal healthcare utilization in the Godong 1 Community Health Center service area had reached a favorable level. Nevertheless, the 31.7% proportion with poor ANC history remains relevant because inadequate contact with maternal health services may reduce opportunities for preventive interventions and early identification of pregnancy-related risks.

Table 1. Distribution of Respondents' Antenatal Care (ANC) History in the Godong 1 Community Health Center Service Area, 2025 (n = 183)

Antenatal Care (ANC) History	Frequency	Percentage (%)
Poor	58	31.7
Good	125	68.3
Total	183	100

As presented in Table 1, the proportion of mothers with good ANC history was more than twice that of mothers with poor ANC history, indicating a predominance of adequate antenatal service utilization in the study population. The classification of ANC history should be interpreted as a multidimensional measure because adequate care depends on whether visits occur at appropriate stages of pregnancy and whether essential services are delivered during those contacts. Kemenkes RI (2025a) emphasizes integrated antenatal care as a comprehensive service that includes maternal and fetal assessment, nutritional monitoring, supplementation, screening, counselling, and identification of pregnancy complications. Consequently, a higher frequency of visits does not necessarily represent optimal ANC when essential service components are not adequately provided or documented. The quality of ANC is particularly important because antenatal contacts provide opportunities to identify maternal nutritional problems and other conditions that may affect fetal development. This interpretation is consistent with evidence that the quality of maternal healthcare utilization is relevant to child health outcomes beyond the simple number of healthcare contacts (Audila & Helda, 2025).

The predominance of good ANC history may reflect relatively favorable utilization of primary maternal healthcare services within the study area. Access to community health centers, midwives,

maternal health records, and the Buku KIA can facilitate continuity of monitoring during pregnancy. Maternal healthcare utilization in Indonesia has also been influenced by the broader expansion of health-service coverage and financial protection associated with the national health insurance system (Rahmawati & Hsieh, 2024). In practical terms, accessible services may make it easier for mothers to attend scheduled visits and receive health education, nutritional assessment, and preventive interventions. The presence of 58 mothers with poor ANC history, however, indicates that service availability alone does not ensure consistent utilization. Individual, household, and contextual factors may interact in determining whether pregnant women obtain antenatal care at the recommended times.

Maternal knowledge and perceptions can influence adherence to recommended antenatal visits because women who understand the preventive purpose of ANC may be more likely to seek care before symptoms become apparent. Family support, transportation, employment conditions, and accessibility of healthcare facilities may also affect the continuity of maternal healthcare utilization. Zubay et al. (2025) identified several factors associated with completion of K6 ANC, indicating that antenatal attendance is shaped by characteristics extending beyond the immediate clinical need for care. The quality of counselling received during ANC may further influence maternal capacity to recognize pregnancy danger signs and implement recommended health practices. Evidence from a randomized controlled trial also indicates that WHO-recommended ANC contacts combined with health education can contribute to improved maternal care processes (Shirin et al., 2025). The findings in Godong 1 therefore suggest that maintaining good ANC coverage requires both adequate service provision and strategies that address barriers to continued attendance.

The relationship between ANC quality and maternal-fetal health is also relevant to nutritional programming during pregnancy. Antenatal contacts provide opportunities to assess maternal nutritional status, identify potential deficiencies, provide supplementation, and counsel mothers regarding appropriate dietary practices. Prenatal nutritional interventions have been associated with outcomes related to fetal growth and infant development, although their effectiveness depends on the nutritional context and characteristics of the intervention (Dewey et al., 2024). Maternal nutritional conditions are particularly important because fetal growth represents one pathway through which prenatal exposures may influence subsequent child growth. Adequate ANC can facilitate earlier recognition of nutritional risks, although ANC itself should not be interpreted as an isolated determinant of later stunting. This distinction is important because child linear growth is influenced by a complex accumulation of prenatal, postnatal, nutritional, infectious, and socioeconomic exposures (Benjamin et al., 2023).

From a public-health perspective, the 31.7% proportion of mothers with poor ANC history provides a specific target for strengthening maternal healthcare services in the Godong 1 area. Strategies may include early pregnancy registration, appointment reminders, active monitoring of missed visits, optimization of Buku KIA utilization, and strengthened communication between midwives, community health workers, and families. Community-based follow-up can be particularly useful for identifying pregnant women who experience barriers to attending routine services. Efforts to improve ANC should also emphasize the content and timing of care rather than focusing exclusively on the number of contacts. This approach is consistent with the concept of ANC as a positive pregnancy experience in which preventive, promotive, and clinical services are integrated throughout pregnancy (Tunçalp et al., 2022). The distribution observed in this study therefore provides evidence for continued strengthening of ANC continuity while recognizing that subsequent child growth is determined by multiple interacting factors.

Stunting Incidence Among Toddlers Aged 24–59 Months

The findings showed that among 183 toddlers aged 24–59 months in the working area of Godong 1 Community Health Center in 2025, 133 toddlers (72.7%) were classified as stunted, while 50 toddlers (27.3%) had normal height-for-age status. This distribution indicates that impaired linear growth represented a substantial health concern within the study population. Stunting status was determined using the Height-for-Age Z-score (HAZ), with children classified as stunted when HAZ was <-2 SD and as normal when HAZ was ≥ -2 SD. Height-for-age is an important indicator for identifying chronic growth impairment because it reflects the cumulative effects of nutritional and health conditions over time (Kemenkes RI, 2025b). The high proportion of stunting observed in this study should not be interpreted as the consequence of a single nutritional factor, since linear growth is influenced by interconnected maternal, child, household, and environmental conditions. The finding

therefore provides an important basis for examining the prenatal and postnatal factors associated with impaired growth among toddlers in the study area.

Table 2. Distribution of Stunting among Toddlers in the Working Area of Godong 1 Community Health Center in 2025 (n=183)

Stunting among Toddlers	Frequency	Percentage (%)
Normal (HAZ ≥ -2)	50	27.3
Stunting (HAZ < -2)	133	72.7
Total	183	100

As shown in Table 2, the number of toddlers classified as stunted was considerably higher than those with normal height-for-age status. Specifically, 72.7% of the children had HAZ values below -2 SD, indicating that growth faltering was prevalent within the observed population. Stunting represents a form of chronic undernutrition that develops through prolonged exposure to inadequate dietary intake, recurrent infections, and unfavorable maternal and environmental conditions (Katoch, 2022). Early-childhood linear growth faltering may occur progressively as multiple nutritional and health-related constraints accumulate during the first years of life (Benjamin et al., 2023). The observed distribution suggests that a considerable proportion of children may have experienced growth-related risks before reaching the age of 24 months, even though anthropometric status was assessed when they were 24–59 months old. This temporal dimension is important because the determinants of current stunting may have originated during pregnancy or the early postnatal period.

The occurrence of stunting can be understood through a life-course perspective in which prenatal and early-life exposures contribute to subsequent health and developmental outcomes. Maternal nutritional status, pregnancy complications, fetal growth, birth weight, breastfeeding practices, complementary feeding, and recurrent childhood infections may interact to influence linear growth. Nutritional deprivation during critical developmental periods can have consequences extending from childhood into adulthood, particularly when inadequate nutrition is accompanied by repeated illness and limited access to appropriate health services (Soliman et al., 2021). Evidence from maternal nutrition research further indicates that nutritional interventions during pregnancy can influence pregnancy, birth, and early infant outcomes (Dewey et al., 2024). These pathways indicate that the growth status of toddlers should be considered as the accumulated outcome of exposures occurring across different stages of development. The high proportion of stunting in this study therefore provides a relevant context for assessing maternal ANC history as a potential prenatal factor associated with child growth.

The proportion of stunting identified in this study was substantially higher than the national prevalence reported in the 2024 Indonesian Nutrition Status Survey, which was 19.8% (Kemenkes RI, 2025b). The difference should be interpreted cautiously because the present study involved a specific population within the service area of one community health center, whereas national estimates represent a much broader population. Local variations in socioeconomic status, dietary practices, maternal characteristics, environmental sanitation, healthcare utilization, and access to nutrition programs may contribute to differences in stunting prevalence between populations. Indonesian evidence indicates that stunting is influenced by interconnected household and maternal factors, including socioeconomic conditions, caregiving practices, and access to essential health services (Wulandari et al., 2025). Geographic variation is also relevant because the distribution of stunting can differ across areas within Central Java, reflecting differences in demographic and socioeconomic characteristics (Devi et al., 2025). The relatively high prevalence observed in Godong 1 consequently warrants attention to locally relevant determinants rather than relying only on broader population-level estimates.

Dietary adequacy after birth is another important determinant of linear growth among children aged 24–59 months. Adequate energy, protein, essential amino acids, vitamins, and minerals are required to support tissue formation and continued physical development during early childhood. Animal-source foods have been identified as important sources of essential amino acids and nutrients that support linear growth among young children in low- and middle-income countries (Parikh et al., 2022). Complementary foods with adequate nutrient density and dietary diversity can also improve the availability of nutrients required for optimal physical growth (Asare et al., 2022). Inadequate dietary

intake may interact with recurrent infections, which can further impair nutrient absorption and increase nutritional requirements. The high number of stunted toddlers in this study therefore needs to be viewed within a broader nutritional pathway extending from maternal health during pregnancy to feeding and health conditions after birth.

Stunting also has implications beyond physical height because persistent growth restriction may be associated with adverse developmental and health outcomes. Chronic nutritional deprivation during early childhood can affect cognitive development, learning capacity, and later-life health, particularly when exposure occurs during critical periods of development (Soliman et al., 2021). Early identification of growth faltering is consequently important because interventions are more effective when nutritional and health-related problems are addressed before deficits become persistent. Primary healthcare services can contribute through routine growth monitoring, nutrition counselling, breastfeeding support, complementary-feeding education, infection prevention, and referral of children requiring further assessment. These interventions are particularly relevant in community-based settings where mothers and caregivers have regular contact with health workers through integrated maternal and child health programs. In the present study, the substantial proportion of stunting provides an important basis for examining whether the quality and adequacy of maternal ANC history are associated with subsequent growth outcomes among toddlers aged 24–59 months.

Relationship Between Antenatal Care (ANC) History and Stunting Incidence Among Toddlers Aged 24–59 Months

The analysis demonstrated a statistically significant relationship between maternal Antenatal Care (ANC) history and stunting incidence among toddlers aged 24–59 months in the working area of Godong 1 Community Health Center. Among 58 mothers with a poor ANC history, 55 toddlers (94.8%) were classified as stunted, while only 3 toddlers (5.2%) had normal height-for-age status. In comparison, among 125 mothers with a good ANC history, 78 toddlers (62.4%) were stunted and 47 toddlers (37.6%) had normal growth status. The Chi-Square analysis produced a p-value of 0.000 with an X^2 value of 20.980, indicating a statistically significant association between ANC history and stunting incidence. The odds ratio (OR) of 11.047 indicates that toddlers whose mothers had a poor ANC history had 11.047 times higher odds of being stunted than toddlers whose mothers had a good ANC history. This finding is consistent with evidence indicating that inadequate ANC utilization may be associated with adverse child growth outcomes (Amalia et al., 2025). The magnitude of the observed association indicates that maternal healthcare during pregnancy represents an important factor to consider in the prevention of childhood growth impairment.

Table 3. Relationship Between Maternal Antenatal Care (ANC) History and Stunting Incidence among Toddlers Aged 24–59 Months in the Working Area of Godong 1 Community Health Center

Maternal ANC History	Stunting		Normal		Total		p-value	x^2	OR
	n	%	n	%	n	%			
Underweight	55	94.8	3	5.2	58	100	0.000	20.980	11.047
Normal	78	62.6	47	37.6	125	100	—	—	—
Total	133	72.7	50	27.3	183	100	—	—	—

As presented in Table 3, the proportion of stunting was substantially higher among toddlers whose mothers had a poor ANC history than among those whose mothers had a good ANC history. The difference was 32.4 percentage points, with stunting occurring in 94.8% of the poor-ANC group compared with 62.4% of the good-ANC group. The statistical result indicates that the observed distribution is unlikely to have occurred solely through random variation within the study population. ANC provides opportunities to monitor maternal and fetal conditions, identify pregnancy-related risk factors, provide nutritional interventions, and deliver counselling relevant to maternal and child health (Kemenkes RI, 2025a). The finding is also consistent with Ningsih et al. (2025), who reported an association between ANC visits and stunting among toddlers aged 24–59 months. Similar evidence has been reported by Mente et al. (2024), showing that ANC-related factors and maternal nutritional status are relevant to stunting incidence among toddlers. The consistency between the present findings and

previous studies strengthens the interpretation that inadequate prenatal healthcare may contribute to an unfavorable trajectory of child growth.

The relationship between ANC history and stunting can be explained through the maternal–fetal pathway, in which maternal health during pregnancy influences fetal development and subsequent child growth. Regular ANC enables healthcare providers to monitor maternal nutritional status, detect anemia and other complications, assess fetal development, and provide interventions when risk factors are identified. Maternal undernutrition during pregnancy may restrict fetal growth and increase the probability of adverse birth outcomes that can subsequently influence growth during infancy and childhood. Evidence from randomized controlled trials has shown that improving maternal nutritional intake during pregnancy can influence pregnancy, birth, and infant outcomes, supporting the importance of prenatal nutritional conditions for early growth (Dewey et al., 2024). ANC also provides an opportunity to deliver nutrition education and preventive services that may modify maternal behaviors during pregnancy. These mechanisms are consistent with the conceptual understanding that stunting is influenced by interconnected maternal, nutritional, health-service, and environmental factors rather than by a single exposure (Katoch, 2022). The association identified in this study therefore has biological and public-health plausibility, although the cross-sectional design does not establish a direct causal relationship.

The quality of ANC is particularly relevant because the value of antenatal services depends not only on the number of visits but also on their timing and the services delivered during each contact. The WHO ANC framework emphasizes a positive pregnancy experience that includes effective clinical assessment, preventive interventions, nutrition-related support, and communication between healthcare providers and pregnant women (Tunçalp et al., 2022). Kemenkes RI (2025a) similarly emphasizes integrated antenatal services that include maternal and fetal assessment, nutritional monitoring, supplementation, laboratory examination, counselling, and identification of pregnancy risk factors. When these components are delivered appropriately, maternal problems that may interfere with fetal growth can be identified and managed earlier. Conversely, inadequate ANC may reduce opportunities to identify nutritional deficiencies, pregnancy complications, or other conditions that can adversely affect fetal development. The present finding that poor ANC history was associated with markedly higher stunting prevalence is compatible with this service-delivery pathway. The result also supports the argument that evaluation of ANC should consider service quality and completeness rather than focusing exclusively on the number of maternal visits.

Several previous studies provide further support for the observed relationship between ANC and childhood stunting. Amalia et al. (2025) reported that ANC examination was associated with stunting incidence among toddlers, highlighting the importance of maternal healthcare during pregnancy in supporting child growth. Audila and Helda (2025) also identified an association between the quality of pregnancy care and stunting among Indonesian children aged 6–23 months using national survey data. Ummah et al. (2025) reported a relationship between ANC and nutritional parenting with stunting incidence among toddlers aged 24–59 months, indicating that prenatal healthcare may interact with subsequent caregiving practices. Harumi et al. (2025) similarly demonstrated that ANC history and parenting patterns were related to stunting among toddlers. These findings suggest that the pathway from ANC to child growth may involve both prenatal conditions and behaviors established after birth. The convergence of evidence across different Indonesian populations provides contextual support for the association identified among toddlers in the Godong 1 Community Health Center service area.

Despite the strong association, the OR of 11.047 should be interpreted within the limitations of the study design and variables included in the analysis. The cross-sectional design identifies an association between documented ANC history and current stunting status but does not demonstrate that inadequate ANC directly caused the child's growth impairment. Stunting is a multifactorial outcome that can also be influenced by dietary intake, infection, birth weight, maternal nutritional status, parenting practices, socioeconomic conditions, and environmental sanitation. Research on childhood malnutrition emphasizes the contribution of multiple interacting determinants, making it inappropriate to attribute stunting to a single maternal healthcare exposure (Katoch, 2022). The large difference in stunting prevalence between the ANC categories nevertheless indicates that ANC history is an important marker of maternal and child health vulnerability in the study population. The finding can be used to strengthen preventive strategies that identify mothers with inadequate ANC histories and connect them with continued maternal and child health services. Such strategies should be integrated

with nutritional monitoring, growth surveillance, infection prevention, and family-based interventions to address the broader determinants of stunting.

Integrated Interpretation of ANC and Stunting Findings

The findings indicate that the relationship between ANC history and stunting should be understood within a broader continuum of maternal and child health. The proportion of stunting was substantially higher among toddlers whose mothers had a poor ANC history, while the statistical analysis demonstrated a significant association between the two variables. ANC provides a period in which maternal nutritional status, pregnancy complications, fetal growth, and health-related risks can be identified before they influence subsequent child development. The quality of antenatal services is therefore relevant because adequate care can provide preventive, promotive, and clinical interventions during a critical developmental period (Kemenkes RI, 2025a). The relationship observed in this study does not imply that ANC alone determines the occurrence of stunting because child growth is also influenced by postnatal nutrition, infection, caregiving, socioeconomic conditions, and environmental factors. A comprehensive interpretation requires consideration of how prenatal healthcare interacts with conditions experienced by children after birth. The conceptual pathways connecting maternal ANC with subsequent child growth are summarized in Table 4.

Table 4. Integrated Pathways Linking Maternal ANC History to Stunting among Toddlers Aged 24–59 Months

Pathway	Relevant ANC Component	Potential Maternal/Fetal Effect	Potential Implication for Child Growth
Maternal Nutritional Status	Nutritional assessment and counselling	Identification and management of maternal nutritional problems	Improved conditions for fetal growth
Pregnancy Risk Detection	Maternal and fetal examination	Early identification of pregnancy complications	Reduced risk of adverse fetal growth
Micronutrient Support	Iron supplementation and related preventive services	Improved maternal micronutrient status	Supports fetal development and birth outcomes
Health Education	Nutrition, danger-sign, and pregnancy counselling	Improved maternal knowledge and health practices	Potentially improved maternal and infant care
Continuity of Care	Scheduled and complete ANC contacts	Sustained monitoring throughout pregnancy	Greater opportunity for timely intervention
Referral and Management	Detection and follow-up of high-risk conditions	Appropriate treatment or referral	Reduced exposure to preventable pregnancy-related risks

As indicated in Table 4, ANC may influence child growth through several interconnected pathways rather than through a single mechanism. Nutritional assessment can identify maternal deficiencies, while clinical monitoring can identify conditions that require treatment or referral. The opportunity to provide counselling also allows health workers to address maternal dietary practices, supplementation, preparation for delivery, and early childcare before the child is born. Maternal and fetal monitoring during pregnancy is particularly relevant because inadequate prenatal conditions can contribute to impaired fetal growth and unfavorable birth outcomes. Prenatal nutritional conditions have been shown to influence pregnancy and infant outcomes, supporting the importance of maternal nutrition as part of the pathway between ANC and early growth (Dewey et al., 2024). These mechanisms provide a plausible explanation for why inadequate ANC history may be associated with a greater probability of stunting during later childhood. The findings therefore support an integrated approach in which ANC is positioned as an early entry point for stunting prevention rather than as an isolated intervention.

The preventive value of ANC may also extend beyond direct clinical services because antenatal contacts create repeated opportunities for communication between healthcare providers, mothers, and

families. Information obtained during ANC can influence maternal awareness of nutritional requirements, pregnancy danger signs, preparation for delivery, and subsequent child-care practices. The continuation of these behaviors after delivery may affect breastfeeding, complementary feeding, hygiene practices, and utilization of child health services. Dietary quality during early childhood is particularly important because sufficient nutrient intake supports physical growth and development, while inadequate dietary diversity may limit essential nutrient availability (Asare et al., 2022). The pathway from ANC to stunting prevention can therefore involve behavioral and caregiving processes that continue after pregnancy. This interpretation is consistent with evidence showing that ANC and nutrition-related parenting are associated with stunting among toddlers aged 24–59 months (Ummah et al., 2025). The implication is that maternal ANC records can serve not only as indicators of pregnancy-care utilization but also as potential markers for identifying families requiring continued nutritional and developmental support.

The findings also indicate the importance of maintaining continuity between maternal healthcare and child health services at the primary-care level. Mothers with inadequate ANC histories may represent a group that requires additional attention during subsequent child growth monitoring because the observed study association indicates greater vulnerability to stunting. Health workers can use maternal and child records to identify missed ANC contacts, review maternal risk factors, and connect families with appropriate nutrition and growth-monitoring services. Continuity between antenatal, delivery, postnatal, and child health services is consistent with the principle of integrated care across the maternal and child health continuum (Tunçalp et al., 2022). Community-based personnel can contribute by strengthening communication with families and facilitating timely access to health facilities. This approach is particularly relevant where socioeconomic and access-related conditions may influence utilization of maternal and child health services. Local evidence has also shown that geographic and population characteristics contribute to variation in the distribution of stunting across areas of Central Java (Devi et al., 2025).

A practical framework derived from the findings is presented in Table 5 to distinguish the major intervention points across the maternal and child health continuum. The framework emphasizes that prevention should begin during pregnancy and continue through early childhood. At the maternal stage, interventions should prioritize timely ANC, nutritional assessment, supplementation, risk detection, and health education. During infancy and toddlerhood, these efforts should be complemented by breastfeeding support, adequate complementary feeding, infection prevention, and regular growth monitoring. Evidence indicates that animal-source foods can provide essential amino acids and nutrients important for linear growth among young children in low- and middle-income settings (Parikh et al., 2022). Coordinated interventions are therefore more appropriate than strategies focusing exclusively on increasing the number of ANC visits. The framework also provides a basis for interpreting the present findings within a broader prevention strategy.

Table 5. Integrated Intervention Framework for ANC and Stunting Prevention

Intervention Stage	Priority Action	Main Target	Expected Contribution
Pregnancy	Timely and complete ANC	Pregnant women	Early identification of maternal and fetal risks
Pregnancy	Nutritional assessment and supplementation	Mothers at nutritional risk	Improvement of maternal nutritional condition
Pregnancy	Health education and counselling	Mothers and families	Improved health knowledge and preparation
Delivery and Postnatal Period	Continuity of maternal and newborn care	Mothers and newborns	Reduced interruption of essential care
Infancy	Breastfeeding and nutrition support	Infants and caregivers	Improved nutritional intake
Toddler Period	Complementary feeding and dietary diversification	Toddlers and caregivers	Adequate nutrient intake for growth

Toddler Period	Growth monitoring and early intervention	Toddlers	Early detection of growth faltering
Community Level	Family and community engagement	Families and caregivers	Improved utilization and continuity of services

The synthesis demonstrates that the association between ANC history and stunting is consistent with a continuum in which maternal health conditions, healthcare utilization, nutritional practices, and child-care environments interact over time. The strong association identified in the present study provides an empirical basis for strengthening ANC as part of a broader stunting-prevention strategy in the Godong 1 Community Health Center service area. Nevertheless, the cross-sectional design and the limited number of variables analyzed mean that the findings should be interpreted as an observed association rather than definitive evidence of causality. Childhood stunting has a multifactorial etiology involving nutrition, infection, maternal characteristics, household conditions, and access to health services (Katoch, 2022). Future studies could incorporate maternal nutritional status, birth weight, dietary intake, infectious disease history, socioeconomic characteristics, parenting practices, and environmental sanitation to provide a more comprehensive model of stunting risk. Such variables would allow subsequent research to examine whether the association between ANC history and stunting persists after adjustment for important potential confounding factors. The integrated evidence nevertheless supports strengthening early identification and follow-up of mothers with inadequate ANC histories as one component of comprehensive stunting prevention.

CONCLUSION

Most mothers in the service area of Godong 1 Community Health Center had a good history of Antenatal Care (ANC), with 125 respondents (68.3%) categorized as having good ANC histories and 58 respondents (31.7%) categorized as having inadequate ANC histories. The findings indicate that most mothers had received antenatal services with adequate frequency, appropriate timing, and documented components of care during pregnancy. Despite this favorable distribution, the proportion of mothers with inadequate ANC histories remains substantial and indicates the need to strengthen continuity and quality of maternal healthcare services. Among the 183 toddlers aged 24–59 months included in the study, 133 children (72.7%) were classified as stunted based on a Height-for-Age Z-score (HAZ) below -2 , while 50 children (27.3%) had normal growth status. This high proportion indicates that linear growth impairment remains an important public health concern in the study area and requires attention from maternal, child, and community health programs. The occurrence of stunting should be understood as a multifactorial condition influenced by nutritional intake, infection, caregiving practices, socioeconomic circumstances, environmental conditions, and maternal health during pregnancy (Katoch, 2022). The findings therefore emphasize the importance of strengthening preventive interventions from pregnancy through early childhood to address factors that may contribute to impaired child growth.

Statistical analysis demonstrated a significant relationship between maternal ANC history and stunting incidence among toddlers aged 24–59 months in the service area of Godong 1 Community Health Center, with a Chi-Square value of 20.980 and a p-value of 0.000 (<0.05). Mothers with inadequate ANC histories had a substantially higher proportion of children experiencing stunting, with 55 of 58 children (94.8%) classified as stunted compared with 78 of 125 children (62.4%) among mothers with good ANC histories. The odds ratio of 11.047 indicates that toddlers whose mothers had inadequate ANC histories had approximately 11 times higher odds of experiencing stunting than toddlers whose mothers had good ANC histories. This finding supports previous evidence that the utilization and quality of ANC are associated with child growth outcomes and may contribute to early identification and management of maternal and fetal risk factors (Amalia et al., 2025). The relationship also reinforces the importance of ANC as part of a continuum-of-care approach because adequate antenatal services provide opportunities for nutritional monitoring, supplementation, health education, risk detection, and appropriate referral during pregnancy (Kemenkes RI, 2025a). Nevertheless, the cross-sectional design and the multifactorial nature of stunting mean that the observed association should not be interpreted as evidence that inadequate ANC alone directly causes stunting. Future interventions should integrate improvements in ANC coverage and quality with nutrition education,

growth monitoring, infection prevention, family involvement, and continued child health services to reduce the risk of stunting across the first 1,000 days of life.

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