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# Determinants of Stunting in Children Under Five in Pontianak City: A Systematic Literature Review

## *Faktor Penyebab* Stunting *Pada Bayi Bawah Lima Tahun Di Kota Pontianak: Tinjauan Literatur Sistematis*

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**ABSTRACT**

Stunting remains a significant public health issue in Pontianak City, with long-term impacts on children's growth and development. This study aims to identify the main determinants of stunting among children under five in Pontianak, determine the dominant contributing factors, and formulate evidence-based policy recommendations for more effective and context-specific interventions. A Systematic Literature Review (SLR) was conducted using articles from Google Scholar and Scopus, published between 2015 and 2024. Literature was retrieved using the keywords "Stunting" AND "Pontianak" via the Publish or Perish application and selected based on predefined inclusion and exclusion criteria. The dominant factors contributing to stunting include inadequate protein, calcium, phosphorus, micronutrient intake, infectious diseases (e.g., diarrhea), and poor household sanitation. Moderate factors include maternal height, young maternal age, Posyandu activity, exposure to cigarette smoke, and inappropriate complementary feeding. Some factors, such as exclusive breastfeeding and immunisation, showed mixed results across studies. Reducing stunting in Pontianak requires targeted nutritional interventions, improved sanitation, and strengthened community-based health services tailored to local contexts and supported by evidence-based strategies

***Kata Kunci:***
*Stunting, Balita, Faktor Risiko, Pontianak*

***ABSTRAK***

*Stunting masih menjadi masalah kesehatan serius di Kota Pontianak, dengan dampak jangka panjang terhadap pertumbuhan dan perkembangan anak. Penelitian ini bertujuan mengidentifikasi faktor-faktor utama penyebab stunting pada balita di Kota Pontianak, menentukan faktor dominan, dan merumuskan rekomendasi berbasis bukti untuk intervensi yang efektif. Studi ini menggunakan pendekatan Systematic Literature Review (SLR) dengan sumber artikel dari Google Scholar dan Scopus tahun 2015–2024. Literatur dicari menggunakan kata kunci "Stunting" AND "Pontianak" melalui aplikasi Publish or Perish, dan diseleksi berdasarkan kriteria inklusi dan eksklusi tertentu. Faktor dominan penyebab stunting meliputi rendahnya asupan protein, kalsium, fosfor, zat gizi mikro, infeksi (seperti diare), serta buruknya sanitasi rumah tangga. Faktor sedang meliputi tinggi badan ibu, usia ibu muda, keaktifan Posyandu, paparan asap rokok, dan pemberian MP-ASI. Beberapa faktor seperti ASI eksklusif dan imunisasi menunjukkan hasil yang bervariasi antar studi. Penurunan stunting di Pontianak memerlukan intervensi gizi spesifik, perbaikan sanitasi, dan penguatan layanan kesehatan masyarakat berbasis bukti dan konteks lokal.*

## 1. INTRODUCTION

Stunting remains a critical global health issue, particularly in low- and middle-income countries, as it reflects underlying poverty, food insecurity, and inadequate maternal and child healthcare services [1]. In 2022, an estimated 148.1 million children under five representing 22.3% of the global population in this age group were affected by stunting, contributing to nearly half of all under-five deaths worldwide [2,3]. Stunting impairs physical growth and increases the risk of chronic illness, premature mortality, and long-term economic losses due to reduced productivity, higher healthcare costs, and a decline in per capita income of up to 7%, exacerbating social inequality and poverty[3]. This condition seriously threatens the quality of human capital and the economic burden on nations. According to the World Health Organisation (WHO), stunting is considered a significant public health concern when the prevalence among children under five exceeds 20% [4] .

The prevalence of stunting in Indonesia remains relatively high, despite showing a significant downward trend over the past decade. According to the 2024 Indonesian Nutritional Status Survey (SSGI), the stunting prevalence declined from 37.6% in 2013 to 19.8% in 2024 [5]. While this figure has fallen below the World Health Organisation's (WHO) threshold of 20%, stunting prevalence in Indonesia exhibits stark regional disparities. One of the provinces with a high prevalence is West Kalimantan (Kalbar), which reached 26.8% far above the national average. Notably, Pontianak City, the provincial capital with comparatively better access to healthcare services, still reports a stunting rate of 22.3% [5]. The prevalence of stunting in Pontianak City is 22.1%, with the highest cases reported in East Pontianak District (29.4%), followed by Southeast Pontianak (25.1%), North Pontianak (22.1%), West Pontianak (21.1%), South Pontianak (16.1%), and Central Pontianak (15.1%) [6]. The persistently high prevalence in several districts suggests that the issue is influenced not only by the availability of health facilities but also by more complex socio-economic and environmental factors.

Several studies have found that certain areas in Pontianak particularly those along riverbanks and peatland zones have relatively high stunting rates [7]. Geographic vulnerabilities, limited access to clean water, poor sanitation, and socio-economic hardships contribute synergistically to worsening conditions [7,8]. Furthermore, stunting in Pontianak reflects complex characteristics, with strong interactions among nutritional deficiencies[8], infectious diseases[9], sanitation conditions[6], caregiving practices, and socio-economic variables[10,11]. Although various studies have been conducted, their findings remain inconsistent. Some emphasise the significance of nutritional intake and sanitation, while others highlight the influence of caregiving behaviours or recurrent infections. These discrepancies may result from variations in research methodology, geographic coverage, and respondent characteristics across studies.

This situation underscores the need for a comprehensive and systematic review to compile, analyse, and synthesise findings from existing studies on stunting in Pontianak City. Such a review is essential to identify the most locally dominant risk factors, ensuring that interventions are genuinely evidence-based and context-specific. In response to these challenges, this study was designed as a Systematic Literature Review (SLR) to answer the following research questions: (1) What factors influence stunting among children under five in Pontianak City based on the reviewed literature? (2) Which factors are most dominant in contributing to stunting in the area? Furthermore, (3) What efforts have been documented to reduce stunting based on existing literature? This review aims to produce a comprehensive scientific synthesis of the key

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determinants of stunting and provide evidence-based policy recommendations to support more effective, adaptive, and sustainable interventions.

## 2. METHOD

This literature-based study employs the Systematic Literature Review (SLR) method. The literature included in this review was selected based on predefined inclusion and exclusion criteria [12,13]. The inclusion criteria encompassed research articles published between 2015 and 2024, from national and international journals, explicitly addressing the determinants of stunting among children under five in Pontianak City. Only full-text articles available in either Indonesian or English were considered. Only studies with a case-control, cross-sectional, or descriptive research design were included. In contrast, the exclusion criteria eliminated articles that were literature reviews, theoretical discussions, opinion pieces, or conference proceedings. Articles unrelated to stunting in children under five, or studies conducted outside of Pontianak City, were also excluded from the analysis. A detailed depiction of the selection process is presented in the PRISMA flow diagram (Figure 1).

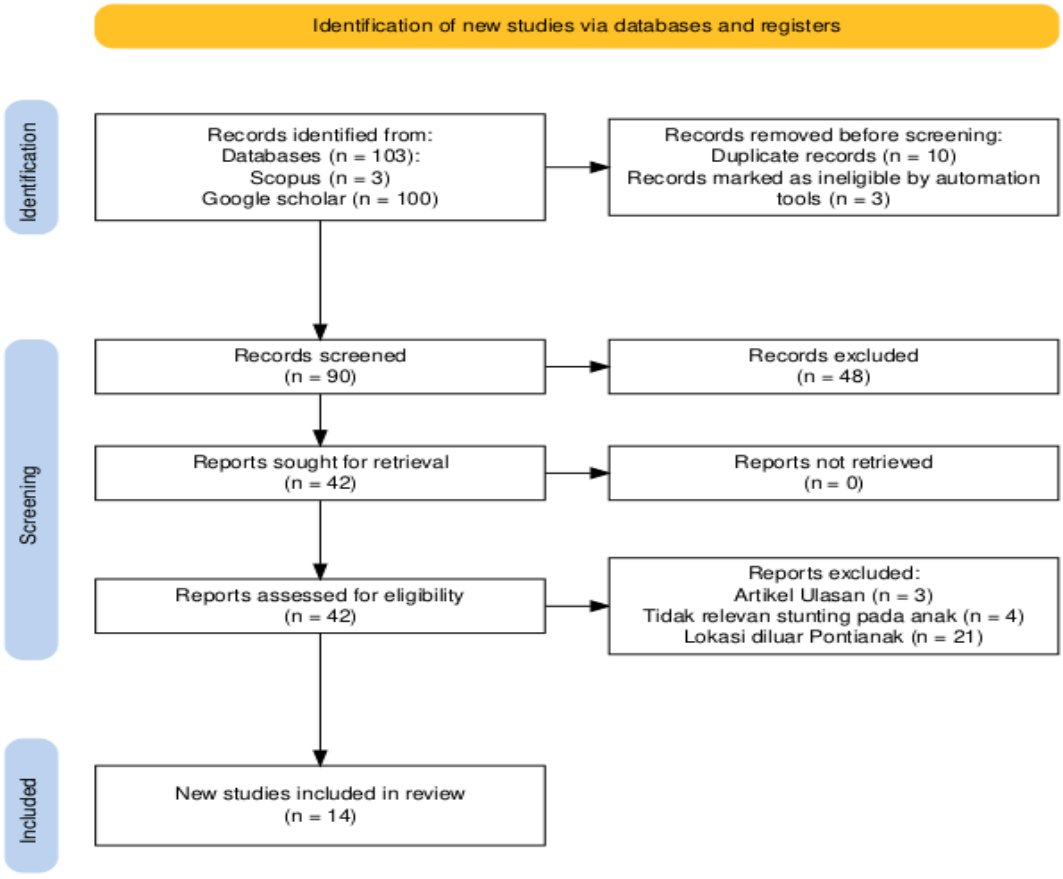


**Figure 1. PRISMA Flow Diagram**

The literature search was conducted using the Publish or Perish application through Google Scholar and Scopus databases, utilising the Boolean keyword combination: "Stunting" AND "Pontianak". The initial search yielded 103 articles (100 from Google Scholar and three from Scopus). After removing 10 duplicate entries and three conference proceedings, 90 articles remained. Title and abstract screening further

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reduced the pool to 42 relevant articles. A full-text assessment was then conducted, during which 28 articles were excluded for failing to meet inclusion criteria, such as review articles, lacking relevance to stunting, or focusing on areas outside Pontianak. Ultimately, 14 articles were deemed eligible and included in the review. The selection process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol [14].

## 3. RESULTS

This literature review examined 14 research articles that met the inclusion criteria and were relevant to stunting among children under five in Pontianak City. The selected studies employed various research designs, including cross-sectional, case-control, descriptive qualitative, and quantitative observational methods. The sample sizes varied across studies, ranging from 40 to 287 respondents (children aged 0–59 months) in different areas of Pontianak City. The results of the Systematic Literature Review are presented in Table 1.

**Table 1. Results of the Systematic Literature Review**

| Article Title | Study Location | Study Design | Sample Size | Findings |
|---|---|---|---|---|
| Faktor-Faktor yang Berhubungan dengan Kejadian *Stunting* pada Balita (12–59 Bulan) di Wilayah Kerja UPTD Puskesmas Saigon [6]. | East Pontianak District | Cross-sectional | Children aged 12–59 months; total n = 88 | Exclusive breastfeeding was significantly associated with stunting (p = 0.045; OR = 3.7; 95% CI: 0.952–14.199). A history of low birth weight (LBW) was also significant (p = 0.006; OR = 2.7; 95% CI: 1.336–5.549), as were infectious disease history (p = 0.024; OR = 2.2; 95% CI: 1.159–4.317) and environmental sanitation (p = 0.042; OR = 2.7; 95% CI: 1.025–7.025). Meanwhile, maternal age during pregnancy or childbirth showed no significant association with stunting (p = 0.797; OR = 0.8; 95% CI: 0.144–4.9543). |
| Analisis Zat Gizi Mikro dan Tinggi Badan Ibu Balita terhadap Kejadian *Stunting* di Daerah Gambut dan Aliran Sungai [7] | Tanjung Hilir and Siantan Hulu Subdistricts, Pontianak Utara and Pontianak Timur Districts | Case-Control (pendekatan retrospektif) | 100 children under five (50 cases, 50 controls) | Low levels of micronutrients in the peatland areas showed a significant association with stunting risk (p=0.029; OR=0.24; 95% CI: 0.06–0.93). In contrast, micronutrient levels in the riverbank areas (p=0.039; OR=5.80; 95% CI: 0.515–65.49) were not significant in the multivariate analysis. Maternal height, both in the peatland (p=0.467; OR=1.70) and riverbank areas (p=0.629; OR=3.33), did not show a significant association with stunting. |

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| Article Title | Study Location | Study Design | Sample Size | Findings |
|---|---|---|---|---|
| Determinan Kejadian Stunting pada Anak Usia 24–59 Bulan di Wilayah Puskesmas Saigon Kecamatan Pontianak Timur [8] | Saigon Subdistrict, East Pontianak District | Case-Control Study (Analytical Survey) | *Children aged 24–59 months; Total n = 64 (32 cases, 32 controls)* | Significant factors associated with stunting included low birth weight (LBW) (OR = 2.89), maternal chronic energy deficiency (CED) (OR = 0.094), exclusive breastfeeding (OR = 6.67), complementary feeding (MP-ASI) (OR = 120), and information on the First 1,000 Days of Life (OR = 2.4). In the multivariate model, complementary feeding (MP-ASI) was the most influential factor (OR = 0.005), followed by information on the First 1,000 Days of Life (OR = 37.3); LBW was not significant in the model. Maternal education was also statistically significant (p = 0.021). |
| Faktor-Faktor yang Berhubungan dengan Status *Stunting* Anak Usia 24–59 Bulan di Wilayah Kerja UPK Puskesmas Siantan Hulu [9]. | North Pontianak | Cross-sectional & retrospective cohort | Children aged 24–59 months; n = 89 | 68.5% not stunted; 40.4% had infections; 74.2% had a good diet; 68.5% of mothers had low education; 52.8% were unemployed. Infection (p=0.004), diet (p=0.006), and birth length (p<0.001) were significant. Education & employment were not. |
| Sosio Kultural Masyarakat Daerah Tepian Sungai Kapuas Tanjung Hilir Terkait *Stunting* [10]. | Tanjung Hilir Subdistrict, East Pontianak District | Qualitative Descriptive | Children aged 24–59 months; Total n = 40 | Parenting patterns among mothers were relatively similar for both stunted and non-stunted children, with the majority practicing early initiation of breastfeeding (EIBF) and giving colostrum. However, 45% of stunted children consumed meals less than three times a day, and 60% had never received a nutritionally balanced diet. Their living environment was also unhealthy: 50% lacked access to clean water, and 75% had no standard waste disposal facilities. |
| Calcium serum level of stunting and non stunting children aged 24-59 months [15]. | East and North Pontianak | Cross-sectional | n = 90 (37 stunted, 53 non-stunted) | All aspects of development were significantly associated with stunting (p < 0.05). |
| Protein, calcium and phosphorus intake of stunting and non stunting children aged 24-59 months [16]. | East and North Pontianak Subdistricts | Cross-sectional | Children aged 24–59 months; n = 90 | Stunted children had significantly lower protein, calcium, and phosphorus intake (p < 0.05). Stunting prevalence was 1.87 times higher with low protein intake, 3.625 times with low calcium, and 2.29 times with low phosphorus. |
| Prevalensi Kejadian *Stunting* pada Balita (12–59 Bulan) di Pontianak Tenggara, Kalimantan Barat [17]. | Southeast Pontianak | Cross-sectional | n = 287 | Protein intake <100% RDA (p=0.002; OR=4.02), diarrhea (p=0.000; OR=14.4), maternal age <20 years (p=0.019; OR=2.7) were significant. Exclusive breastfeeding, ISPA, pneumonia, LBW, and sanitation were not. |

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| Article Title | Study Location | Study Design | Sample Size | Findings |
|---|---|---|---|---|
| *History of Early Breastfeeding Initiation and Food Intake With The Even Stunting of Children Aged 6-59 Months* [18]. | Siantan Hulu Subdistrict, North Pontianak District | *Cross-sectional* | Children aged 6–59 months; Total n = 94 Early | Initiation of Breastfeeding (EIBF) was significant it reduced the risk of stunting;<br>Food intake was also significant adequate food intake lowered the risk of stunting. |
| *Determinants of Stunting in Siantan Hulu Subdistrict, North Pontianak Based on Spidergram Analysis* [19]. | Siantan Hulu Subdistrict, North Pontianak District | Descriptive observational study (quantitative with spidergram) | Children aged 24–59 months; Total n = 80 | Stunting was significantly influenced by child characteristics, exposure to cigarette smoke, healthcare services, immunization, and stunting education (IEC). Non-significant factors included maternal characteristics, early initiation of breastfeeding, exclusive breastfeeding, and water and environmental sanitation. A total of 91.3% of stunted children had a history of infection, 70% of mothers were exposed to cigarette smoke during pregnancy, and 66.3% of children were exposed to cigarette smoke. Although 95% of children received exclusive breastfeeding, it was not found to be significantly associated with the prevention of stunting. |
| Indicators of the Home Environment in Families at Risk of Stunting in the Murai Valley of Pontianak City [20]. | Siantan Hulu and Siantan Hilir Sub-districts, North Pontianak District | Cross-sectional | Children aged 0–59 month; Total n= 58 | The majority of respondents exhibited poor personal hygiene (91.4%), inadequate household cleanliness (62.1%), and unimproved sanitation facilities (93.1%). Although regular handwashing was commonly practiced, the use of masks and nail trimming remained low. Most households had access to clean water; however, stagnant water and waste were still present, and many toilets did not meet proper sanitation standards. |
| *Lead Exposure and Stunting Incidents in Children Aged 3–5 Years in Pontianak City, West Kalimantan, Indonesia* [21]. | Siantan Hulu and Siantan Hilir Sub-districts, North Pontianak District | Case-Control | Children aged 3–5 years; Total n = 60 (30 stunted cases, 30 controls) | There was no significant difference in lead (Pb) levels in drinking water between stunted and non-stunted children ($p = 0.068$), but urinary Pb levels showed a significant difference ($p \leq 0.001$). A weak but significant correlation was found between Pb levels in drinking water and urine ($r = 0.302$; $p = 0.019$). The majority of respondents consumed rainwater (81.7%), and 85% of households were exposed to cigarette smoke at home. Nutritional intake was generally adequate, but environmental Pb exposure remains a concern. |

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| Article Title | Study Location | Study Design | Sample Size | Findings |
|---|---|---|---|---|
| Status ASI Eksklusif dan Sanitasi Total Berbasis Masyarakat (STBM) terhadap Kejadian Stunting di Tanah Gambut dan Bantaran Sungai Kapuas [22]. | Tanjung Hilir and Siantan Hulu Subdistricts, North and East Pontianak Districts | Case-control study (retrospective approach) | Children aged 24–59 months; total n = 100 (50 cases, 50 controls) | Exclusive breastfeeding was found to be significantly associated with stunting in both areas ($p < 0.05$), where children who were not exclusively breastfed had a 7.5 times higher risk of stunting in peatland areas and 3.3 times higher along riverbanks. Community-Based Total Sanitation (STBM) practices were not significantly associated with stunting in peatland areas ($p > 0.05$), but showed a significant bivariate relationship along riverbanks ($p < 0.05$). |
| Riwayat Posyandu dan ASI Eksklusif dengan Kejadian Stunting Anak Usia 6-59 Bulan di Wilayah Kelurahan Siantan Hulu Kota Pontianak [23]. | Siantan Hulu Sub-district, North Pontianak District | Cross-sectional | Children aged 6–59 months; Total n = 94 | Regular attendance at Posyandu ($p = 0.002$; OR = 4.1) and exclusive breastfeeding ($p = 0.001$; OR = 14.8) were significantly associated with stunting. Children who regularly attended Posyandu had a 0.3 times lower risk of stunting (OR = 0.348; 95% CI: 0.126–0.959), and those who received exclusive breastfeeding for 6 months had a 0.083 times lower risk (95% CI: 0.018–0.385). |

The findings generally indicate that nutritional intake is a key determinant of stunting. Several studies have shown that inadequate intake of protein, calcium, phosphorus, and micronutrients such as iron, zinc, iodine, and vitamin A is significantly associated with an increased risk of stunting. For instance, children with low protein intake have been reported to have a 1.87 times higher risk of stunting, while insufficient calcium and phosphorus intake increase the risk by 3.625 and 2.29 times, respectively, compared to those with adequate nutritional intake[16]. Similarly, other studies in peatland areas demonstrated a significant association between micronutrient deficiencies and stunting incidence [7].

Beyond nutritional factors, infectious disease history consistently emerges as a significant risk factor. Studies conducted in Southeast Pontianak, Saigon Health Centre, and Siantan Hulu found that children with a history of infections, particularly diarrhea, were more vulnerable to stunting [8,17,19]. These findings are further supported by previous studies that emphasise the importance of disease prevention through immunisation and improved access to healthcare services[19]. Maternal caregiving behaviours such as exclusive breastfeeding, early initiation of breastfeeding (EIB), and regular attendance at *Posyandu* (integrated health posts) were also significantly associated with stunting [21]. Several studies found that exclusively breastfed children for the first six months had a significantly lower risk of stunting [6,18]. Children who were not exclusively breastfed were 7.5 times more likely to experience stunting in peatland areas and 3.3 times more likely in riverbank communities[22]. In addition, frequent *Posyandu* visits appeared to offer a protective effect against stunting[23]. However, some studies reported varied results regarding the influence of EIB and exclusive breastfeeding, depending on interactions with other factors such as maternal characteristics and environmental conditions.

Environmental factors, including household cleanliness, sanitation quality, exposure to cigarette smoke [19,20] and heavy metals [21], also emerged as critical findings in the reviewed literature. A study along the Kapuas River highlighted that poor sanitation

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and unhygienic conditions such as limited access to clean water and inadequate waste disposal worsened stunting outcomes [10]. Exposure to cigarette smoke, both during pregnancy and after birth, was found to significantly increase the risk of stunting, in some cases, outweighing the effects of nutrition [19]. Other studies also identified lead exposure particularly lead found in urine samples as a significant risk factor, although the impact from drinking water exposure showed inconsistent results [21]. Some studies emphasised specific local issues, such as inappropriate complementary feeding practices and a lack of maternal knowledge regarding the First 1,000 Days of Life. Improper complementary feeding was associated with a heightened risk of stunting. Maternal knowledge of nutrition, the 1,000-day window, and participation in public health programs played a vital role in stunting prevention [8].

Interestingly, variables such as maternal and paternal height, maternal occupation, and maternal education did not consistently demonstrate significant associations with stunting. While some studies found links, the results were not universally consistent. Overall, this literature review underscores that stunting among children under five in Pontianak is a multidimensional issue influenced by various factors including nutritional intake, child health, caregiving practices, and environmental conditions. The most frequently identified strong predictors include inadequate nutrition, infectious diseases, poor sanitation, lack of exclusive breastfeeding, and infrequent *Posyandu* visits. Additionally, socio-economic and environmental behaviours, such as cigarette smoke and exposure to heavy metals, also appeared as important determinants in several studies. These findings highlight the need for a comprehensive intervention approach that addresses nutrition improvement, infection control, environmental sanitation, health education, and appropriate parenting practices tailored to the context of Pontianak City.

## 4. DISCUSSION

### 4.1. Factors Influencing the Incidence of Stunting

#### Nutritional Intake and Dietary Patterns

Nutritional intake and dietary patterns emerged as one of the most dominant factors identified in this literature review. Several studies have confirmed that inadequate protein, calcium, and phosphorus intake significantly increases the risk of stunting. Children with low protein intake were 1.87 times more likely to experience stunting; low calcium intake increased the risk by 3.625 times, and low phosphorus intake by 2.29 times compared to children with adequate intake[16]. Furthermore, deficiencies in micronutrients such as iron, zinc, iodine, and vitamin A were also significantly associated with stunting, particularly in peatland areas, where children with micronutrient deficiencies were 0.24 times more likely to be stunted than those with adequate micronutrient intake. Complementary feeding (MP-ASI) practices also emerged as a significant factor. In certain studies, inappropriate MP-ASI practices significantly increased the risk of stunting, with an odds ratio (OR) as high as 120 [8], indicating serious concerns regarding the quality and administration of complementary foods. Additionally, access to information regarding the first 1,000 days of life (HPK) was a protective factor, with an OR of 2.4. However, serum calcium levels did not significantly correlate with stunting ($p = 0.966$) [15], suggesting that not all nutritional indicators are directly associated with stunting outcomes[15]. suggesting that not all nutritional indicators are directly associated with stunting outcomes.

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### Socio-economic Factors

Socio-economic aspects showed a more moderate influence in this review. A study conducted in Siantan Hulu sub-district revealed that maternal education (68.5%) and maternal employment status (52.8%) were not significantly associated with stunting ($p > 0.05$) [9]. Similarly, maternal age at pregnancy or childbirth did not consistently exhibit statistical significance [6]. These factors have a limited direct impact on stunting within Pontianak City. Nevertheless, maternal education remained a significant factor in some studies, as reported in the Saigon Health Centre study ($p = 0.021$) [8]. Conversely, other familial characteristics such as parental height and maternal age under 20 at childbirth were shown to be significant in several studies. Children born to mothers under 20 had a 2.70 times higher risk of stunting ($p = 0.019$) [17]. highlighting the relevance of biological family characteristics in influencing stunting risk.

### Access to Health Services

Other influential factors include access to health services, particularly attendance at integrated health posts (*Posyandu*), which demonstrated a strong association with stunting. A study in Siantan Hulu found that children who regularly visited *Posyandu* had a 0.348 times lower risk of stunting ($p = 0.002$; OR = 4.1)[23]. emphasising the critical role of basic health services in stunting prevention. Findings regarding immunisation were mixed. Some studies linked incomplete immunisation to increased stunting risk [19], while others found no significant relationship. Utilisation of health services, such as nutrition counselling and maternal and child health education, was not frequently reported in the reviewed studies but is generally considered to have potential as a protective factor.

### Environment and Sanitation

Environmental and sanitation factors have consistently emerged as significant contributors to stunting risk in Pontianak City. Studies conducted in urban Pontianak indicate that the majority of families with stunted children live in poor environmental conditions: 62.1% had unclean household environments, 93.1% had inadequate sanitation facilities, and 91.4% of children exhibited poor personal hygiene [20]. Another study found that poor sanitation increased the risk of stunting with an odds ratio (OR) of 2.7 ($p = 0.042$) [6]. Exposure to cigarette smoke was also found to be a significant factor, with 70% of mothers exposed during pregnancy and 66.3% of children exposed at home (study in Siantan Hulu)[19]. These findings indicate that indoor environmental exposure is critical in stunting incidence. Meanwhile, the role of the Community-Based Total Sanitation (STBM) program shows mixed results. In riverbank areas, STBM was significantly associated with stunting ($p < 0.05$), whereas in peatland areas, no significant association was found [22].

### Infection History

Literature analysis from various studies in Pontianak reveals that a history of infections such as diarrhea and recurrent illnesses significantly contributes to stunting risk. A study found that 40.4% of children with a history of infection were at significant risk of stunting ($p = 0.004$), underscoring infection as a major risk factor[9]. Research involving 287 respondents also identified diarrheal history as a strong predictor of stunting, increasing the risk by 14.4 times (OR = 14.4; 95% CI: 7.658–27.079; $p < 0.001$) [17]. Similar findings showed a significant association between infectious disease history

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and stunting (p = 0.024; OR = 2.2; 95% CI: 1.159–4.317) [6]. A more recent study confirmed that 91.3% of stunted children had a history of infectious disease [19]. Frequent infections during early childhood increase the risk of nutritional deficits, as energy needed for growth is diverted toward immune responses [24]. These findings confirm that infection particularly diarrhea and recurrent illnesses is one of Pontianak's most critical determinants of stunting. Therefore, efforts to prevent and control infections through improved sanitation, expanded health services, and community health education are essential to reducing stunting prevalence in the region.

**Parenting Practices and Maternal Knowledge**

Parenting practices and maternal knowledge are also key factors influencing stunting. Studies indicate that nutritional education and awareness of the first 1,000 days of life (HPK) are vital in stunting prevention [8]. In several areas, poor feeding practices such as low meal frequency and inadequate intake of nutritious food were identified as primary risk factors. A study along the Kapuas River showed that 45% of stunted children were fed fewer than three times daily, and 60% rarely consumed balanced, nutritious meals[10]. Limited nutritional education and low awareness of healthy parenting practices exacerbate these poor caregiving patterns. On the other hand, some studies have found that factors such as Early Initiation of Breastfeeding (EIBF) and parenting styles do not consistently show significant associations with stunting [19], with findings varying across studies.

**Local-Specific Factors in Pontianak City**

Local-specific factors represent unique findings in the context of stunting in Pontianak City. Several studies have identified that peatland areas and riverbank settlements exhibit distinct stunting risk characteristics. In peatland regions, micronutrient deficiencies and limited food access are the primary concerns [7], while in riverbank areas, poor sanitation and limited access to clean water constitute significant challenges [22]. A case-control study conducted in Siantan Hulu and Siantan Hilir sub-districts, North Pontianak, revealed no significant difference in lead (Pb) levels in drinking water between stunted and non-stunted children (p = 0.068)[21]. However, the study found a significant difference in urinary Pb levels between the two groups (p ≤ 0.001), indicating that the primary source of Pb exposure may originate from environmental factors other than drinking water. Although the correlation between Pb levels in drinking water and urine was weak, it remained statistically significant (r = 0.302; p = 0.019), suggesting a contributory role of drinking water in total Pb exposure.

Most respondents (81.7%) reported using rainwater as their primary source of drinking water, and 85% of households had at least one member who smoked indoors. These findings highlight that environmental lead exposure, regardless of adequate nutritional intake, is a critical issue warranting further attention as a potential risk factor for stunting in Pontianak City. A comprehensive summary of factors found to be associated or not associated with stunting in Pontianak, based on the reviewed literature, is presented in Table 2.

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**Table 2. Factors Associated with Stunting in Pontianak City**

| Category of Factors | Influential Factors | Non-Influential Factors |
|---|---|---|
| Nutritional Intake & Diet | Protein, calcium, phosphorus intake; Micronutrient intake; Energy adequacy; Poor dietary intake; Complementary feeding (MP-ASI); Information on the First 1,000 Days of Life | Calcium levels |
| Child Health History | History of infection (diarrhea); History of low birth weight (LBW) (in some studies); Lack of early breastfeeding initiation (in some studies); Incomplete immunisation | Exclusive breastfeeding (varied results, some not significant); Acute respiratory infection (ARI); Pneumonia; LBW (not significant in some studies) |
| Parenting Practices & Health Care | Participation in Posyandu; Exposure to cigarette smoke; Nutrition education; Poor personal hygiene; Poor household cleanliness; Inadequate toilet sanitation; Poor environmental sanitation | Parenting style; Early Initiation of Breastfeeding (EIB) (varied results); Exclusive breastfeeding (varied results); Community-Based Total Sanitation (STBM) |
| Family & Environmental Factors | Parental height; Maternal age < 20 years at childbirth; Exposure to lead (Pb) in child's urine | Maternal education; Maternal occupation; Maternal age during pregnancy/childbirth; Lead (Pb) exposure in drinking water |

The literature review reveals that numerous factors contribute to the occurrence of stunting. Stunting in children is generally caused by a combination of factors, most notably inadequate nutritional intake, recurrent infections, and unfavourable socio-economic and environmental conditions. This situation is further exacerbated by low parental education levels, unstable income, and limited access to adequate sanitation and quality healthcare services [5].

### 4.2. The Multidimensional Impact of Stunting in Pontianak

Findings from this review indicate that stunting in Pontianak is a multidimensional issue that affects various aspects of a child's life, as well as the family and community. The consequences of stunting extend beyond physical growth delays, potentially impeding cognitive, motor, and social development in the long term. The most consistently contributing factors to stunting in Pontianak include insufficient intake of protein, calcium, phosphorus, and energy, as well as micronutrient deficiencies, a history of infections such as diarrhea, and poor personal hygiene, household cleanliness, and toilet sanitation, as summarised in Table 3.

**Table 3. Dominant Contributing Factors to Stunting in Pontianak**

| Influence Priority | Influential Factors | Additional Notes |
|---|---|---|
| **Most Dominant** | Protein, calcium, and phosphorus intake; Energy adequacy; Micronutrient intake; History of infection (diarrhea); Poor personal hygiene, household cleanliness, and toilet sanitation | Most consistently significant factors across multiple studies are associated with a 2–5 times higher risk of stunting. |
| **Moderate** | Parental height (especially maternal); Maternal age < 20 years at childbirth; Attendance at Posyandu; Exposure to cigarette smoke; Nutrition education; Complementary feeding (MP-ASI) | Significant in several studies, though the effects may vary or be context-dependent |

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| Influence Priority | Influential Factors | Additional Notes |
|---|---|---|
| **Weak / Contextual** | Lack of early breastfeeding initiation (EIB); Incomplete immunisation; Information on the First 1,000 Days of Life; Exposure to lead (Pb) in child's urine | Influential only in specific studies or under certain environmental conditions |

These factors increase the risk of stunting by two to five times compared to children not exposed to them. The impact extends beyond child health, affecting household economic burdens, diminishing children's future quality of life, and escalating the strain on the regional health system. Stunting not only hinders physical growth but also increases the risk of chronic diseases, premature death, and long-term economic losses due to reduced productivity, higher healthcare costs, and a decline in per capita income by up to 7%, thereby exacerbating social inequality and poverty [3]. In addition, several factors with moderate influence still warrant attention, such as parental (especially maternal) height, maternal age below 20 years at childbirth, regular visits to community health posts (*Posyandu*), household exposure to cigarette smoke, nutrition education, and complementary feeding practices. These factors have shown significant associations in some studies, although their effects vary depending on sociocultural and environmental contexts.

Contextual or weaker factors also emerged, including early initiation of breastfeeding, incomplete immunisation, limited awareness of the first 1,000 days of life (HPK), and exposure to heavy metals (e.g., Pb) in children's urine. While these factors were relevant in certain studies, their impact tends to manifest under specific conditions or in interaction with other risk factors. Additionally, some variables yielded inconsistent or mixed results across studies, such as exclusive breastfeeding, early breastfeeding initiation, low birth weight, environmental sanitation, and implementing Community-Based Total Sanitation (STBM). These variations reflect differences in local conditions, research methodologies, and respondent characteristics. Other factors, such as maternal education, parental employment, maternal age at pregnancy or delivery, caregiving patterns, and lead exposure from drinking water, were generally insignificant but still deserve consideration in specific contexts.

### 4.3. Stunting Intervention

Based on the level of influence of the identified risk factors, addressing stunting in Pontianak City requires an integrated approach, prioritising interventions that target the most consistent and dominant contributors. The priority is specific nutrition interventions, particularly those aimed at increasing the intake of protein, calcium, phosphorus, energy, and micronutrients among children. This can be achieved through supplementary feeding programs, local food fortification, and family education on affordable, healthy diets. Second, strengthening primary healthcare services is crucial, especially in preventing and managing infections such as diarrhea, which has been identified as a significant risk factor. Health centres (*puskesmas*) should play a more active role in early detection of infectious diseases, expanding immunisation coverage, and enhancing preventive health services for under-fives. Third, improving sanitation and environmental hygiene should be a strategic focus for local governments, particularly ensuring access to clean water, adequate sanitation facilities, and household-level promotion of clean and healthy living behaviours (PHBS). Programs such as sanitary

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latrines, drainage improvements, and reducing household pollutant exposure (e.g., cigarette smoke) should be prioritised.

Furthermore, interventions targeting moderately influential factors such as increasing *Posyandu* attendance, promoting community nutrition education, and reducing household smoke exposure should be sustained. *Posyandu* needs to be strengthened as a centre for child growth monitoring and nutrition education, rather than being limited to routine weight measurement. Collective community movements are essential to improve parenting practices, reinforce family-based nutrition awareness, and promote understanding of balanced nutrition and healthy sanitation. Social support, the empowerment of health cadres, and the involvement of community and religious leaders can serve as practical approaches to expand outreach and encourage behaviour change.

Local-specific factors such as geographic challenges in peatlands and riverbanks, environmental pollutant exposure, and cultural practices must also be considered when designing intervention programs for Pontianak. Generic interventions that overlook local characteristics may prove ineffective in reducing stunting prevalence. This reinforces the notion that stunting is not a problem that can be resolved through quick-fix approaches. Stunting is driven by diverse determinants that vary across regions depending on their social, economic, and environmental contexts[25]. While various interventions can be implemented, the root cause of stunting remains closely tied to poverty a structural and complex challenge that cannot be resolved in the short term. Therefore, community-based interventions that integrate local wisdom and account for regional characteristics are essential to ensuring the long-term effectiveness of stunting prevention programs. Nutritional problem-solving must be comprehensive and sustained [5].

## 5. CONCLUSION

The findings of this review indicate that stunting among children under five in Pontianak City is a complex and multidimensional public health issue. The most dominant contributing factors are inadequate nutrient intake particularly protein, calcium, phosphorus, energy, and micronutrients. Additionally, a history of infection (mainly diarrhea) and poor environmental sanitation, including substandard housing hygiene and inadequate toilet facilities, consistently emerge as significant determinants of stunting. Moderately influential factors, such as maternal height, young maternal age, Posyandu activity, exposure to cigarette smoke, complementary feeding practices, and nutrition education, also play a role in several studies, though their effects appear more variable. Meanwhile, factors such as Early Initiation of Breastfeeding (EIB), incomplete immunisation, lack of information on the First 1,000 Days of Life, and exposure to heavy metals (e.g., lead) tend to be context-specific or significant only under certain conditions. Overall, stunting in Pontianak is shaped by the interplay of nutritional, infectious, sanitation-related, caregiving, and social environmental factors. Local contextual elements such as the geographic characteristics of peatlands and riverbanks serve as important determinants influencing the region's stunting risk profile.

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**Author Contributions**

U: conceptualised the study, designed the research, and developed the methodology; APW: collected and analysed the data, drafted and edited the manuscript.

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