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REVIEW ARTICLE

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Effects of short birth interval on child malnutrition in the Asia-Pacific region: Evidence from a systematic review and meta-analysis

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Abstract

Child malnutrition remains a significant concern in the Asia-Pacific region, with short birth intervals recognised as a potential risk factor. However, evidence of this association is inconclusive. This study aimed to systematically review the existing evidence and assess the summary effects of short birth interval on child malnutrition in the Asia-Pacific region. Five electronic databases were searched in May 2023 to identify relevant studies reporting the association between short birth interval and child malnutrition, including stunting, wasting, underweight, anaemia and overall malnutrition, in Asia-Pacific region between September 2000 and May 2023. Fixed-effects or random-effects meta-analysis was performed to estimate the summary effects of short birth interval on child malnutrition. Out of 56 studies meeting the inclusion criteria, 48 were included in quantitative synthesis through meta-analysis. We found a slightly higher likelihood of stunting (n = 25, odds ratio [OR] = 1.13; 95% confidence interval [CI]: 0.97–1.32) and overall malnutrition (n = 3, OR = 2.42; 95% CI: 0.88–6.65) among children born in short birth intervals compared to those with nonshort intervals, although the effect was not statistically significant. However, caution is warranted due to identified heterogeneity across studies. Subgroup analysis demonstrated significant effects of short birth intervals on child malnutrition in national-level studies and studies with larger sample sizes. These findings underscore short birth intervals as a significant contributor to child malnutrition in the Asia-Pacific region. Implementing effective policies and programs is vital to alleviate this burden, ultimately reducing child malnutrition and associated adverse outcomes, including child mortality.

KEYWORDS

Asia-Pacific region, child malnutrition, short interval pregnancy, systematic review and meta-analysis

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1 | BACKGROUND

Childhood malnutrition remains a significant global public health concern, impacting an estimated 200 million children under the age of five (UNICEF & World Bank, 2021). Among these children, approximately 149 million are affected by stunting (low height for age), 45.4 million suffer from wasting (low weight for age) and 38.9 million are classified as overweight or obese (UNICEF & World Bank, 2021). The majority of these cases (around 63%) are concentrated in low- and lower-middle-income countries (LMICs) across Africa, Asia, Latin America and the Caribbean (UNICEF, 2022). Asia-Pacific countries significantly contribute to the overall burden of child malnutrition in Asia, with approximately one in three children in the region affected by this issue (UNICEF, 2021). The higher prevalence of child malnutrition in the Asia-Pacific significantly contributes to child morbidity and mortality rates (Rahman et al., 2023). Moreover, it imposes a considerable economic burden, costing approximately $10 billion annually, which poses significant challenges for both families and governments in the region (Akseer et al., 2022). The underlying reason is the absence of universal healthcare coverage in the Asia-Pacific countries (Islam, Islam, et al., 2022). Addressing child malnutrition is thus vital for achieving the health-related sustainable development goals (SDGs), particularly those targeting infant and under-five mortality reduction (SDG 3.1 and 3.2) (Grosso et al., 2020).

Childhood malnutrition is influenced by various factors, including poverty, poor maternal health, limited access to clean water and sanitation and insufficient food intake (Bhutta et al., 2013; UNICEF, 2022). These challenges are often exacerbated by adverse characteristics related to pregnancy, such as higher parity, unwanted pregnancies, and high-risk pregnancies (Bhutta et al., 2013). Short birth interval, which accounts for over one-quarter of all live births, can also significantly contribute to child malnutrition (Islam, Islam, et al., 2022). However, studies conducted in Asia-Pacific countries have reported contradictory findings on the association between short birth interval and child malnutrition (Achakzai & Khan, 2016; Jahidur Rahman Khan & Gulshan, 2020; Khan & Raza, 2014; Manzoor & Saeed, 2021; Tiwari et al., 2020). Analysed data from small-scale surveys and variations in the methodologies considered in these studies were the reasons for such contradictions (Karki et al., 2021; Khan & Raza, 2014, 2016; Naz et al., 2020). Factors such as a higher occurrence of unintended pregnancies, short interval pregnancies, rurality and poverty contribute to these variations (Islam, Islam, et al., 2022). Additionally, studies in Asia-Pacific countries and other LMICs often use different criteria to classify short birth interval, deviating from the World Health Organization's recommendation of an interval of less than 24 months between a live birth to the subsequent pregnancy and the extrapolated definition of 33 months between a birth and the subsequent birth (Islam, Billah, et al., 2022). This divergence hampers a comprehensive understanding of the association between short birth interval and child malnutrition. Therefore, this study aims to provide a comprehensive overview of the effects of short birth interval on child malnutrition, taking into account the WHO-recommended duration for birth interval.

Key messages

- Short interval pregnancies pose a persistent public health threat in the South Asian region.
- While a potential link with child malnutrition exists, reported associations often conflict.
- Our findings suggest that short interval births slightly increase the risk of child malnutrition.
- Addressing short interval pregnancies is crucial to mitigate the ongoing nutritional burden in South Asian countries.

2 | METHODS

This systematic review and meta-analysis was conducted following the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) consensus statement (Page et al., 2021). We included relevant studies examining the association between short birth interval and child malnutrition.

3 | SEARCH STRATEGY

To ensure a comprehensive and rigorous search, we conducted a systematic literature search across five databases: Medline, Scopus, Web of Science, the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Maternity and Infant Care. Additionally, we conducted a search for grey literature in ProQuest Dissertations and Theses Global (PQDT), EBSCO Open Dissertations, the Directory of Open Access Books (DOAB), Open Grey and relevant organisational websites such as the WHO, UNICEF and UNFPA, which focus on child and maternal health issues. The search strategy focused on studies published since September 2000 to align with establishing the Millennium Development Goals. The search was initially conducted in July 2022 and later updated in May 2023.

For each database, we developed specific and comprehensive search strategies. These strategies consisted of a combination of free text words, words in titles and abstracts and medical subject headings related to exposure, outcomes and settings. Boolean operators were used to combine the search terms. The entire search strategy and search results for each database are in Supporting Information S1: Tables S1–S5. Additionally, we conducted manual searches of the references cited within the identified articles to identify any additional eligible studies.

4 | STUDY ELIGIBILITY CRITERIA

4.1 | Inclusion criteria

The studies included in this review met the following criteria: they were conducted in the Asia-Pacific region (as defined by the World

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Bank) (World Bank, 2022), written in English, were published since the instigation of the Millennium Development Goals (i.e., September 2000) and followed the WHO recommended interval to define the short birth interval. Furthermore, the eligible studies presented original research utilising quantitative, qualitative or mixed methods and reported on the effects of short birth intervals on child malnutrition, including stunting, wasting and malnutrition.

4.2 | Exclusion criteria

The following studies were excluded from consideration: those conducted in countries outside of the Asia-Pacific region, systematic review and meta-analysis papers, narrative review articles, opinion pieces, studies published only as abstracts, studies collected data or published before September 2000.

4.3 | Study selection process

The identified studies from the database searches were imported into Endnote referencing software (version 20.2.1), and a thorough check for duplicates was conducted. Any duplicate articles found were removed from the Endnote library, and the total count of duplicated articles was recorded. The remaining studies were then exported to Covidence for the initial screening, which involved reviewing titles and abstracts (Covidence Systematic Review Software, 2023). Subsequently, the full texts of the selected studies were comprehensively assessed.

To evaluate the eligibility of the studies, three authors (Desalegn M. Shifti, Catherine Chojenta and Melissa L. Harris) independently reviewed the titles and abstracts. If a study met the eligibility criteria, three authors (Tahir A. Hassen, Catherine Chojenta and Melissa L. Harris) independently examined the full text. In cases where the full text was not accessible, efforts were made to contact the study authors to obtain it. Any disagreements during the initial screening and full-text review were resolved through discussions among the authors and with the lead author (Catherine Chojenta).

4.4 | Data collection process and data items

A data extraction form was designed, tested and modified following the "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) guidelines (Von Elm et al., 2007). Two independent authors (Md Nuruzzaman Khan and Tanmay Bagade) extracted data from the included studies. The process involved capturing various study parameters, such as author and year of publication, country, study setting, study design, sample size and data collection method. Additionally, information on the primary exposure variable (short birth interval) and outcome variables (e.g., stunting, wasting, underweight, anaemia) was extracted for each included study. The reported effect sizes, effect size measures and measured confounders were also documented. In cases where information was unclear, the authors of the original articles were contacted for further details.

4.5 | Quality assessment of the included studies

We utilised a modified version of the Newcastle-Ottawa scale to assess the quality of the included studies. Two reviewers (Md Nuruzzaman Khan and Tanmay Bagade) independently assessed the study quality and assigned scores ranging from 1 to 7 for cross-sectional studies and 1–8 for case-control and cohort studies. Studies were categorised as high quality if they scored ≥6, moderate quality if they scored 4–5 or low quality if they scored 1–3.

4.6 | Statistical analysis

Adjusted odds ratio (aOR) were extracted as the effect measure from each study. If aORs were unavailable, unadjusted ORs with 95% confidence intervals (CIs) were estimated from raw data. We used either a fixed-effects or random-effects model to calculate the summary estimates for the overall effect of short birth interval on different forms of child malnutrition. The selection of the model was based on the assessment of heterogeneity. The extent of heterogeneity was described using I^2 statistics with a corresponding p-value (Higgins, 2003). When the test for heterogeneity indicated moderate (50%) or high (75%) heterogeneity, the pooled estimates of ORs were computed using the random-effects model (Dettori et al., 2022). We explored potential sources of heterogeneity through subgroup and meta-regression analyses using prespecified subgroups such as sample size, confounding factors, study design and study setup. Publication bias was assessed by visually examining funnel plot asymmetry and Egger's regression test. In cases where publication bias was detected, the trim-and-fill method was used to estimate and adjust for potentially missing studies, and the effect size was recalculated accordingly. The statistical analysis was performed using Stata software, version 15.1 (Stata Corp).

5 | RESULTS

5.1 | Search results

In our comprehensive search across five databases, we initially identified a total of 1245 studies after duplicate deletion. Following the screening of titles and abstracts, 1174 studies were excluded, leaving 71 articles for full-text review. During the full-text assessment, 50 articles were excluded based on specific criteria. These exclusions included reporting the wrong outcome ($n = 23$), wrong indication ($n = 11$) and other reasons. An additional 35 studies were included from a manual search of the reference lists of selected papers and specialised journals. Ultimately, 56 studies were included

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in this study, 48 contributing to the quantitative synthesis and the remaining eight in the narrative synthesis (Figure 1, Supporting Information S1: Table S5). The quality assessment of the included studies ranged from moderate to good, as indicated in Supporting Information S1: Tables S7 and S8.

5.1.1 | Study characteristics

Among the 56 studies included in this review, the largest proportion of studies were conducted in Bangladesh ($n = 20$ studies) (Akram et al., 2018; Anwar et al., 2013; Bhowmik & Das, 2017, 2019; Das & Hossain, 2008; Das & Rahman, 2011; Das et al., 2020; Goyal & Canning, 2018; Huda et al., 2018; Islam & Biswas, 2020; Kamal & Moniruzzaman, 2021a; Khan & Gulshan, 2020; Khan & Raza, 2014; Khan et al., 2021; Mozumder et al., 2000; Rayhan & Khan, 2006; Siddiqi et al., 2011; Sultana et al., 2019; Talukder, 2017; Talukder et al., 2018). The second most common country was India ($n = 18$ studies) (Ansuya et al., 2018; Ashok et al., 2015; Basit, 2012; Bharathi, 2021; Chungkham et al., 2020; Gupta & Santhya, 2020; Ishwarji et al., 2018; Khan & Raza, 2016; Patel et al., 2021; Rachana et al., 2020; Rajaram et al., 2003; Rana et al., 2021; Sengupta et al., 2010; Singh et al., 2017; Sk et al., 2021; Som et al., 2006, 2007; Yadav & Nilima, 2021), followed by Nepal ($n = 7$ studies) (Adhikari et al., 2017; Alelign et al., 2015; Dahal et al., 2021; Hanley-Cook et al., 2022; Karki et al., 2021; Pravana et al., 2017; Tiwari et al., 2020) (see Supporting Information S1: Table S6). Additionally, 11 studies were conducted in multiple countries (Achakzai & Khan, 2016; Angeles-Agdeppa et al., 2019; Farid-ul-Hasnain & Sophie, 2010; Gribble et al., 2009; Ikeda et al., 2013; Mendes Kiik & Saleh Nuwa, 2021; Naz & Patel, 2020; Naz et al., 2020;

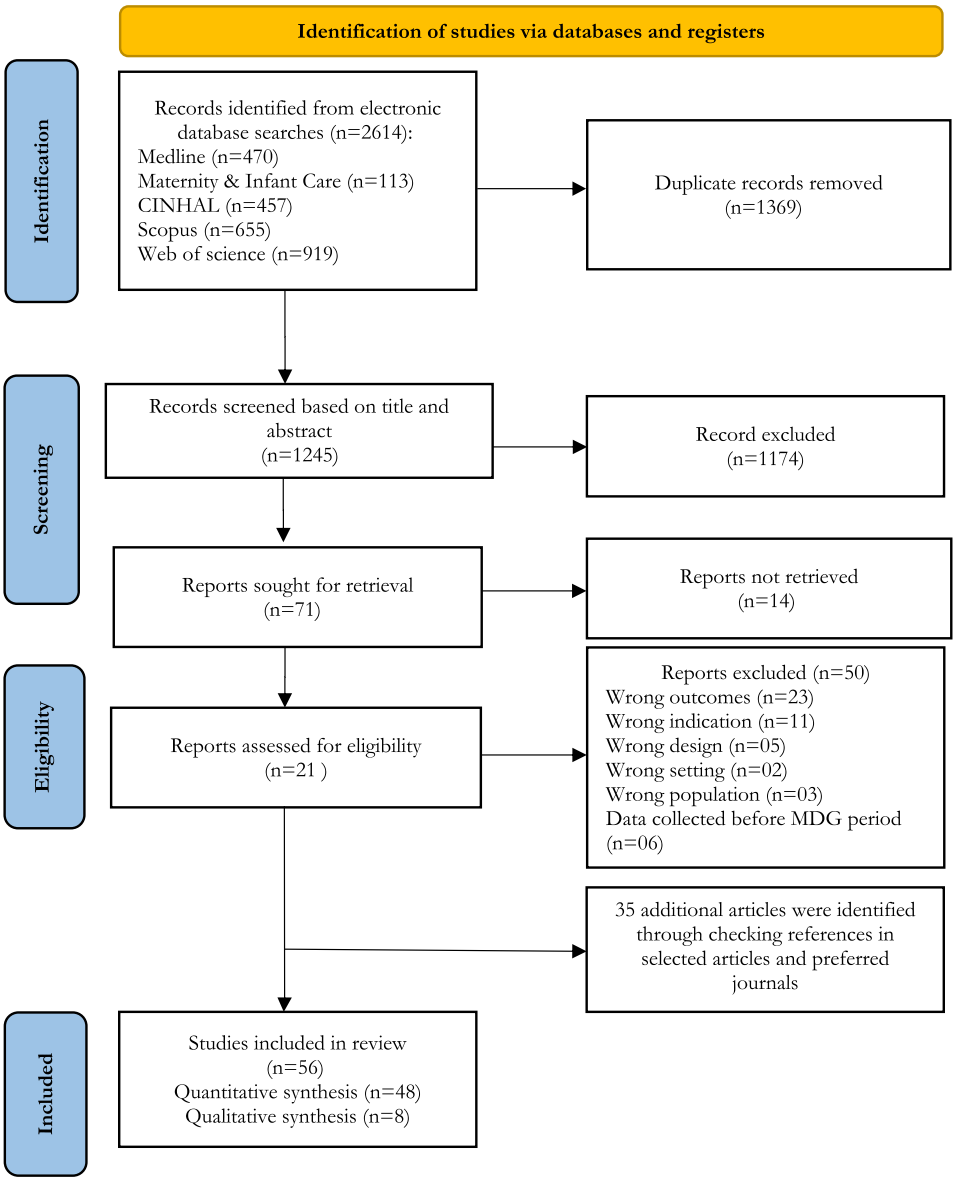


FIGURE 1 Schematic presentation of the studies included and excluded in the systematic review.

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Nojoumi et al., 2004; Olita'a et al., 2014; Satti & Farooq, 2023). Out of the 56 studies, the majority utilised a cross-sectional design ($n = 50$). Furthermore, a significant number of the included studies ($n = 33$) utilised national-level data. Thirty-seven studies reported aORs.

5.1.2 | Relationship between short birth interval and child malnutrition

The results of the association between short birth interval and different forms of child malnutrition are presented in Table 1. Forest plots of corresponding findings are presented in Supporting Information S1: Figures S1–S5, and three corresponding funnel plots are presented in Supporting Information S1: Figures S1a–S5a. There was an increased likelihood of stunting and malnutrition (any form) among children born with short intervals, though they were not statistically significant. Specifically, our findings indicate that the likelihood of being stunted was 1.13 times higher (odds ratio [OR]: 1.13, 95% confidence interval [CI]: 0.97–1.32) among children born with short birth intervals compared to those born with non-short interval births. Similarly, the likelihood of experiencing malnutrition was approximately 2.42 times higher (OR: 2.42, 95% CI: 0.88–6.65) among children born in short intervals compared to those born in nonshort intervals.

Regarding publication bias, the *p*-value of Egger's test did not provide evidence of publication bias except for the results related to stunting. However, visual inspection of the funnel plots revealed asymmetry in studies about stunting, wasting and underweight. Therefore, a sensitivity analysis was conducted using the trim-and-fill method. This analysis hypothetically imputed three studies for stunting and wasting and two studies for underweight, which needed to be included due to publication biases such as small sample size or negative/insignificant findings. The pooled analysis, including these unpublished studies, demonstrated similar directional associations, although the likelihoods were slightly reduced compared to the summary estimate.

The paper lacks essential components necessary for inclusion in the meta-analysis, such as confidence intervals, reviewed narratively, and the relevant findings are presented in Table 2. The narrative review also revealed the negative impact of short birth interval on child malnutrition. Among the nine articles reviewed, researchers consistently reported that the occurrence of short birth interval contributed to a higher likelihood of child malnutrition, with an increase of up to 1.47 times.

5.2 | Stratified analysis

The study revealed substantial heterogeneity ($I^2 > 75\%$) among the included studies and subgroups regarding stunting, wasting and underweight. To investigate the potential sources of heterogeneity, we conducted a stratified analysis based on various factors, including sample size (first quarter, second quarter, third quarter, fourth quarter), confounders (adjusted and unadjusted), study settings (regional, national) and specific countries (Table 3).

Our stratified analysis revealed that the likelihood of stunting was higher among studies with the highest sample size (OR: 1.58, 95% CI: 1.30–1.93), studies that reported adjusted confounders (OR: 1.29, 95% CI: 1.11–1.50) and national-level studies (OR: 1.26, 95% CI: 1.06–1.48). Studies conducted in the Philippines (OR: 1.80, 95% CI: 1.09–2.97) and Cambodia (OR: 2.17, 95% CI: 1.79–2.63) reported higher likelihoods of stunting, while the study in Indonesia (OR: 0.31, 95% CI: 0.15–0.62) reported lower likelihoods of stunting. However, these observations were based on only one study. Regarding wasting, we reported higher likelihoods among studies with large sample sizes (OR: 1.70, 95% CI: 1.28–2.24). A lower likelihood of stunting was

TABLE 1 Summary measures of the relationships between short birth interval and various forms of child malnutrition, publication bias and trim-and-fill estimates for Asia-Pacific Countries.

Characteristics	Number of studies	Summary estimates[b] Odds ratio (OR) (95% confidence interval [CI])	Heterogeneity index (I^2) (%)	Egger bias test *p*-value	Trim-and-fill estimates[a] Number of missing studies	OR (95% CI)
Adverse outcomes						
Stunting	25	1.13 (0.97–1.32)	95.2	0.016	3	1.06 (0.90–1.23)
Wasting	10	0.86 (0.46–1.59)	98.8	0.529	3	0.66 (0.39–1.11)
Underweight	12	1.09 (0.75–1.58)	92.3	0.853	2	0.88 (0.61–1.29)
Anaemia	2	0.94 (0.56–1.59)	20.7	0.990	0	0.94 (0.56–1.59)
Malnutrition (any form)	3	2.42 (0.88–6.65)	48.4	0.243	0	2.42 (0.88–6.65)

Note: Nonshort birth interval was considered the reference category.

[a]The trim-and-fill method simulates studies that are likely to be missing from the literature due to publication or other forms of bias. The trim-and-fill OR estimates what the pooled OR would be if these missing studies were included in the analysis.

[b]Summary estimates were based on random-effects methods except for anaemia and malnutrition (any form), which were based on the fixed-effects model.

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TABLE 2 Findings from the narrative review of the relationship between short birth interval and child malnutrition in the Asia-Pacific region.

Reference	Study design	Country	Sample	Results
Bhowmik and Das (2017)	Cross-sectional study	Bangladesh	7647 children under 5 years	The likelihood of child stunting was 1.47 times higher among children born with short intervals compared to children born in nonshort intervals.
Hanley-Cook et al. (2022)	Cross-sectional study	Nepal	13,262 children under 3 years	Improved linear growth was significantly associated with preceding birth intervals (β [SE]: 0.02 [0.01]; $p = 0.002$) among children under 3 years of age.
Khan and Gulshan (2020)	Cross-sectional study	Bangladesh	6340 children under 5 years	Successive birth intervals had a significant negative effect on child height for age scores. The largest decrease of 0.468 occurred for those in the 10th quantile, while the smallest decrease of 0.276 occurred for those in the 90th quantile in the linear mixed model.
Khan and Raza (2016)	Cross-sectional study	India	27,799 children under 5 years	This study reported that 63% (60.08% and 65.93% for urban and rural areas, respectively) of children born at short intervals were malnourished, compared to 56.65% (50.57% and 62.72% for urban and rural areas, respectively) of children born at nonshort intervals.
Naz and Patel (2020)	Cross-sectional study	Pakistan	3478 children under 5 years	The probability of stunting was found to be 1.02 times higher (coefficient 0.0008; 95% confidence interval [CI]: −0.0016, 0.0031) for a one-unit increase in birth intervals among under five children.
Gupta et al. (2020)	Cross-sectional study	India	259,627 children under 5 years across 629 districts	The probability of child stunting was found to be 1.12 times higher (coefficient 0.109) for a month decrease of birth interval.
Som et al. (2007)	Cross-sectional study	India	3986 children under 3 years	The probability of child stunting was 1.38 times higher among children born at short birth intervals compared to children born at nonshort intervals.

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TABLE 3 Stratified analysis of pooled odds ratio (OR) of stunting, wasting and underweight across selected characteristics.

	Stunting			Wasting			Underweight		
Characteristics	Pooled OR (95% confidence interval [CI])	Heterogeneity, *p*	Meta-regression, *p*	Pooled OR (95% CI)	Heterogeneity, *p*	Meta-regression, *p*	Pooled OR (95% CI)	Heterogeneity, *p*	Meta-regression, *p*
Sample size									
First quarter	0.70 (0.26–1.90)	0.48	<0.05	0.61 (0.28–1.31)[a]	0.20	0.69	1.51 (0.49–4.64)	0.47	0.47
Second quarter	1.17 (0.95–1.44)	0.15		0.90 (0.71–1.13)	0.36		0.46 (0.33–0.64)[a]	<0.01	
Third quarter	1.13 (0.80–1.59)	0.49		0.57 (0.15–2.26)	0.43		0.87 (0.51–1.49)	0.61	
Fourth quarter	1.58 (1.30–1.93)	<0.01		1.70 (1.28–2.24)	<0.04		1.24 (0.51–1.49)[a]	0.29	
Confounders									
Adjusted	1.29 (1.11–1.50)	<0.01	<0.05	1.16 (0.76–1.77)	0.50	0.36	1.22 (0.63–2.36)	0.56	0.32
Unadjusted	0.88 (0.58–1.33)	0.53		0.61 (0.17–2.14)	0.44		0.73 (0.33–1.62)	0.43	
Study setting									
Regional	0.72 (0.39–1.32)	0.29		1.34 (0.87–2.07)	0.19		1.49 (0.72–3.07)	0.28	0.13
National	1.26 (1.06–1.48)	<0.05	<0.05	0.75 (0.34–1.65)	0.47	0.49	0.83 (0.54-1.28)	0.39	
Country									
Pakistan	1.09 (0.75–1.57)	0.65		0.80 (0.66–0.96)[a]	<0.05		0.46 (0.33–0.64)[a]	<0.01	
Bangladesh	1.23 (0.96–1.59)	0.10	0.08	0.70 (0.22–2.22)	0.54	0.94	0.93 (0.60–1.45)	076	0.12
Philippines	1.80 (1.09–2.97)[a]	<0.05		NA					
India	0.84 (0.53–1.33)	0.46		1.34 (0.87–2.07)	0.19		1.23 (0.56–2.72)	0.61	
Cambodia	2.17 (1.79–2.63)[a]	<0.01		NA					
Indonesia	0.31 (0.15–0.62)[a]	<0.01		NA					
Nepal	0.75 (0.33–1.70)	0.13		1.01 (0.84-1.22)[a]	0.91		4.09 (1.87–8.96)[a]	<0.01	

[a]Odds ratio for single study.

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found among studies with a small sample size (OR: 0.61, 95% CI: 0.28–1.31) and studies conducted in Pakistan (OR: 0.80, 95% CI, 0.66–0.96). However, both of these reported associations were based on a single study. Moreover, based on the analysis of single study findings, we found lower likelihoods of underweight among studies whose sample size classified as second quartile (OR: 0.46, 95% CI: 0.33–0.64) and studies conducted in Pakistan (OR: 0.46, 95% CI: 0.33–0.64). Alternatively, a study conducted in Nepal (OR: 4.09, 95% CI: 1.87–8.96) reported a higher likelihood of being underweight.

6 | DISCUSSION

This study aimed to investigate the impact of short birth interval on child malnutrition in the Asia-Pacific region. A total of 56 studies were included, encompassing data from 10 countries in the Asia-Pacific region, out of which 48 studies were part of the quantitative synthesis. Although the results did not demonstrate statistical significance, our findings indicate that short birth interval contributed to an increased occurrence of childhood stunting and malnutrition in general. However, upon conducting a subgroup analysis, we discovered that these effects were significant in studies conducted at the national level and those involving large sample sizes. This suggests that the overall insignificant results can be attributed to studies conducted at the regional level and that the effects of short birth interval on child malnutrition remain significant at the country level. Consequently, this highlights the need for tailored policies and programs aimed at reducing child malnutrition associated with short birth interval.

The lack of significant effects observed in the regional-level studies, which subsequently contributed to the overall insignificance due to their large number, can be attributed to several factors. First, it is essential to note that these studies predominantly rely on less precise methods and small sample sizes. This limitation could impact the statistical power of the analyses, making it more challenging to detect significant associations between short birth interval and child malnutrition. Additionally, the heterogeneity across different regions within the countries of the Asia-Pacific region may introduce variability in the data, further diluting the potential effects of short interpregnancy intervals on child malnutrition (Islam, Islam, et al., 2022, Kamal & Moniruzzaman, 2021b). As a result, the cumulative impact of these small-scale regional studies may overshadow the significant effects observed when analysing data at the national level or when considering larger sample sizes. Therefore, it becomes imperative to acknowledge these limitations at the regional level and emphasise comprehensive studies conducted at the national level with more extensive and diverse samples. Such studies will provide a more accurate understanding of the relationship between short birth interval and child malnutrition in the Asia-Pacific region. It is also worth mentioning that, in this analysis, we focused solely on regional-level studies that followed the WHO recommendation for short birth interval.

However, it is essential to note that these studies represent only a fraction of the total regional level studies, as a significant portion were not included due to our focus on studies adhering to the WHO recommendation. Thus, it is crucial to ensure the utilisation of the WHO recommendation in exploring the actual situation at the regional level. By adopting this approach, policymakers and program developers can make informed decisions and implement tailored strategies to effectively address the issue of child malnutrition associated with short birth interval in the Asia-Pacific region.

There are several potential pathways through which short birth interval can lead to child malnutrition. Insufficient time between pregnancies does not allow the mother's body to fully recover from the previous pregnancy, resulting in nutrient deficiencies (Islam, Billah, et al., 2022). This can impact the mother's milk production and, consequently, affect the health of the baby (Islam, Billah, et al., 2022; Islam, Islam, et al., 2022). Moreover, closely spaced births raise the risk of complications during subsequent pregnancies and childbirth, further increasing the likelihood of malnutrition for the baby (Islam, Billah, et al., 2022; Kamal & Moniruzzaman, 2021b). In addition, closely spaced births can strain the mother's resources, leaving her with limited time to recover, inadequate financial support and insufficient access to nutritious food to adequately provide for both children (Islam, Islam, et al., 2022). Consequently, both the mother and the baby may suffer from poor nutrition. Financial difficulties often lead to the provision of less nutrient-rich and safe foods for the child, increasing the likelihood of infectious diseases, including childhood diarrhoea, which further contributes to child malnutrition (Khan & Raza, 2016). These challenges are often compounded by the mother's lack of care as she needs to care for two small children simultaneously.

Other associated sociodemographic and pregnancy-related characteristics further contribute to the severity of these challenges. For instance, a significant portion of short interval births are unintended for their parents, which may result in parental intentional and unintentional negligence (Islam, Billah, et al., 2022; Islam, Islam, et al., 2022). This can lead to reduced attention to the child's nutritional needs, delayed or inadequate healthcare-seeking behaviours and suboptimal child-care practices (Ayane et al., 2019; Khan et al., 2019). Moreover, short interval pregnancies are more prevalent among mothers with disadvantaged characteristics, including illiteracy, lower age and poverty (Islam, Islam, et al., 2022). These factors can impede access to essential maternal healthcare services, such as prenatal care and nutrition counselling (Islam, Billah, et al., 2022). A lack of appropriate healthcare during pregnancy can contribute to adverse outcomes, including low birth weight and compromised maternal health (Khan, Harris, et al., 2020; Khan, Kumar, et al., 2020). Furthermore, mothers from disadvantaged backgrounds may have limited knowledge about proper infant and child feeding practices, including breastfeeding and the introduction of nutritious complementary foods (Dhami et al., 2021; Russell et al., 2016). This lack of knowledge can hinder the provision of adequate nutrition to the child during the critical early years of development. Collectively, these factors, whether acting independently or in combination, contribute to child malnutrition among short interval pregnancies.

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The findings of these studies highlight some important policies and programs to address child malnutrition related to short interval pregnancies in the Asia-Pacific region. These may include ensuring effective family planning and contraception to prevent unintended and short interval pregnancies in Asia. Additionally, providing nutritional support to children at risk of malnutrition is also crucial.

There are several strengths and limitations of this study. This is the first study in Asia-Pacific region to provide a summary of the effects of short interpregnancy interval on child malnutrition. The WHO recommendation of short interpregnancy interval was used to include studies. We did not restrict the analysis to any particular form of child malnutrition, and we conducted a comprehensive search of five different databases. The data were extracted and analysed comprehensively using both fixed-effects and random-effects models. Stratified analysis was conducted if there was evidence of heterogeneity. Missing studies were also incorporated, and new results were suggested by incorporating them. Therefore, the findings of this study are robust and can help to develop effective policies and programs. However, we summarised findings produced through different study designs, such as cross-sectional and case-control studies. This may make the estimates less precise, although this practice is very common. Second, due to lack of data, we could not perform stratified analysis across many other important factors such as women's age and education. Despite these limitations, this study provides a comprehensive overview of the recent findings in the area and will be valuable in the development of effective intervention programs in the region.

7 | CONCLUSION

In this study, we found that the summary effects of short birth interval on child malnutrition were not statistically significant, although the likelihoods were higher. However, when we performed stratified analysis following evidence of homogeneity, we found that short-interval births had nonsignificant effects on child malnutrition in small-scale studies conducted at the regional level. National-level studies and larger sample studies produced significant effects of short-interval births on child malnutrition. This variation suggests that the insignificant effects are mediated by regional-level studies, which were dominant among the studies included in this review. This indicates that short-interval births are still a significant predictor of child malnutrition. This argues for the need for effective policies and programs to reduce the occurrence of short-interval births and unintended pregnancy, as well as to ensure healthcare and nutritional services for babies born in short intervals. We also suggest conducting large-scale national analyses by following the WHO recommendations to provide a solid evidence base for policy and planning.

AUTHOR CONTRIBUTIONS

Catherine Chojenta and Melissa L. Harris developed the study concept. Catherine Chojenta, Melissa L. Harris and Desalegn M. Shifti developed search strategies, conducted database searches and initial screening. Catherine Chojenta, Melissa L. Harris and Tahir A. Hassen independently conducted the full-text review. Md Nuruzzaman Khan and Tanmay Bagade extracted data and assessed study quality. Md Nuruzzaman Khan conducted the formal analysis and drafted the manuscript. Catherine Chojenta, Melissa L. Harris and Tahir A. Hassen critically reviewed the manuscript. All authors approved the final version of this manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. Associated data of this study are available upon submitting a reasonable request to the corresponding author.

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