

Research Article

“Maternal Characteristics Associated with Stunting Syndrome Among Children under 2 Years of age in Developing Countries

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ABSTRACT:

Background: "Stunting Syndrome" characterized by various pathological alterations, including impaired linear growth during early life. These changes are linked to higher rates of illness and death, diminished physical and neurodevelopmental abilities, reduced economic potential, and an increased susceptibility to metabolic disorders in adulthood. Stunting can be characterized as cyclical due to the tendency for women who experienced stunting during their own childhood to give birth to children who are also stunted. This perpetuates a cycle of poverty and diminished human capital across generations, which poses significant challenges in terms of breaking this pattern.

Objective: The objective of this systematic review was to describe the maternal characteristics associated with stunting syndrome in children under two years of age in developing countries.

Methodology: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA Checklist 2020) was used for data reporting and analysis. Databases including Medline, PubMed, Google scholar and PakMedinet were searched for publications from 2007 to 2023. Authors also performed literatures search using direct websites of local journals.

Results: Total fifteen studies were selected, and the most important factor was no or less maternal education 100 %, second most frequent factor was maternal age 66.66% ranging from 20-29 years. Maternal occupation showed 53.33% of mothers belong to working class and socio-economic status 53.33% mothers had poor socio-economic status. Regarding maternal parity 40% of mothers had up-to 3 children and 40% mothers had up-to 3 ante-natal check-ups during pregnancy. As far as maternal nutritional status is concerned 33.33% mothers were under-weight with BMI <18.5 and regarding age-appropriate child's feeding 33.33% mothers had no awareness about it and did not practice it.

Conclusions: In this systematic review regarding maternal characteristic associated with stunting syndrome in children under two years of age in developing countries are, no or low maternal education, maternal age ranging from 20-29 years, working and poor socio-economic status mothers, mothers up-to 3 children, mothers with up-to 3 ante-natal checkups during pregnancy, under-weight mothers with <18.5 BMI and mothers without awareness of age appropriate child's feeding.

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Key Words: Maternal characteristics, Stunting Syndrome, Children under 2 years, Developing Countries.

INTRODUCTION:

Stunting refers to the proportion of children aged 0 to 59 months whose height for age is below minus two standard deviations (moderate and severe stunting) or minus three standard deviations (severe stunting) from the median of WHO child growth criteria.¹ The issue of stunting is a significant health concern within the society, given that the frequency of stunted children exceeds 40%. Globally, the prevalence of stunting in the world is relatively high, standing at 24%. The countries with the highest rates of stunting are Papua New Guinea and East Timor, both at 50%, followed by Pakistan at 45%, Mozambique at 43%, Zambia at 40%, India at 39%, Nepal at 37%, Indonesia at 36%, Myanmar at 35%, and the United Republic of Tanzania at 35%. In terms of continental coverage, South Asia has the highest prevalence of stunting in the world at 37%, followed by sub-Saharan Africa at 36%, eastern and southern Africa at 36%, west and central Africa at 35%, and East Asia and the Pacific at 11%. The lowest rates of stunting are observed in Latin America, the Caribbean, and the Russian Federation, all at 10%.²

Approximately 70% of stunted growth takes place within the Critical window, which spans from conception through the first two years of life (0-23 months). Inadequate linear growth resulting from nutritional inadequacies, such as insufficient breast feeding, inadequate complementary feeding, chronic malnutrition, and infections, can lead to significant and irreversible physical alterations and neurocognitive impairment. This poses a substantial risk to overall human development³. Stunting in toddlers has both short- and long-

term consequences. Short-term effects include an increase in morbidity and mortality, suboptimal cognitive, motoric, and verbal development in children, and an increase in health care costs. The long-term effects of stunting include a shorter posture than average, an increased risk of obesity and other illnesses, reproductive health issues, a lack of optimal capacity and learning performance, and suboptimal productivity and work capacity⁴. These consequences have significant implications for economic growth and social development within the country⁵. Stunting is a global issue that must be addressed because it affects the welfare of children. One of the six goals of the 2025 Global Nutrition Targets and critical indicators of the second Sustainable Development Goal of Zero Hunger is a 40% reduction in stunting⁶.

The multifaceted responsibilities assumed by mothers have a pivotal role in mitigating the occurrence of stunting. The maternal figure serves as the sole provider of nourishment for an evolving offspring throughout the crucial 1000-day timeframe, namely within the initial six months of existence, wherein the act of breastfeeding is the exclusive means of feeding. Mothers have a pivotal role in influencing their children's dietary patterns by virtue of the food they offer to their offspring. Moreover, it is worth noting that the mother assumes a crucial role in meal planning and food preparation, so underscoring her major responsibility in ensuring adequate child nutrition to mitigate the risk of stunting. The study of the enduring health consequences of childhood malnutrition highlights the importance of addressing this issue prior to a vital phase of child development. It is imperative to inter-

vene early on, with the involvement of maternal care, in order to mitigate the risk of stunting⁷.

Despite the high global prevalence of stunting, the pathogenesis underlying linear growth failure is surprisingly poorly understood. Maternal undernutrition contributes to increases the risk of adverse pregnancy outcomes, childhood mortality and stunting which compounds the intergenerational cycle of stunting. If these intergenerational influences on health have been ignored it would be difficult to achieve SDG's if maternal health is not addressed. However, a comprehensive review of the mother's characteristics leading to stunting syndrome in children under two years of age is not much explored. Therefore, this study was aimed to analyze maternal characteristics associated with stunting syndrome in children under 2 years of age in developing countries.

MATERIALS AND METHODS:

A literature search between 2007 and 2023 was done using databases, PubMed, Medline, Google Scholar, PakMedinet. Various synonymic keywords in each database using Boolean operators and combination of Medical Subject Heading (MeSH) terms were utilized with respect to include the large number of relevant articles. In examining maternal characteristics in child's stunting syndrome worldwide, the authors used the keywords that were "Maternal Characteristics", "Stunting Syndrome", "Children under 2 years of age", and "Developing Countries".

Study selection did not include Randomized Controlled Trials (RCT's), Meta-Analysis, Perspective, Case-Reports, Case- Series and Grey Literature.

Inclusion criteria for the studies eligibility includes st-

udies conducted in African and Asian regions of the world. Observational studies include Cross sectional, Survey and Case-Control studies. Retarded growth in children under two years of age and studies published in English language that referred any causal or contextual factors of restricted growth as recognized by WHO context.

Exclusion criteria includes children under 2 years of age with congenital anomalies, chronic diseases causing loss of appetite and eating disorders were excluded. Eligibility was evaluated, duplicates of articles were removed by four authors. Disagreement between authors was resolved. After the full text assessment, fifteen papers were found to be eligible and included in the final systematic review.

The following information from the selected 15 studies was extracted: author's name, publication year, study setting, and design, size of the sample, stunting prevalence, male: female children ratio and maternal factors including age, education, occupation, nutritional status ,parity, antenatal checkups, age-appropriate feeding, and socio-economic status. Any discrepancies raised during data extraction will be resolved.

The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 Checklist was used. The total articles with relevant titles and abstracts found in the database were 589. After studying these articles, duplicate titles and abstracts were removed and 262 articles were obtained. In the next phase, the remaining full text articles were assessed in more depth and only 49 articles remained and were further screened. Out of these articles, 34 articles were excluded because they did not meet the inclusion criteria and in

the last there were 15 studies which met the criteria. (Fig.1)

RESULTS:

Fifteen included studies in this systematic review were from Asian region and African region which already have high stunting prevalence because of the common issues. (Tab.1). These studies were published from 2007 to 2023 (last 16 years) and were conducted in rural and urban communities and hospitals. The study design of almost all studies was cross-sectional and children under two years were included. Minimum sample size was 65 and maximum was 24,657. The range of stunting prevalence in these studies was from 26.20% to 69%.

Out of fifteen studies, four studies were conducted in Indonesia (Asian Region)^{4,6,7,8} two studies from Bangladesh (Asian Region)^{1,14}, two studies from India (Asian Region)^{2,11}, two from Ethiopia (African Region)^{5,9}, one from Pakistan (Asian Region)³, one from Mimika (Asian Region)¹⁰, one from Rawanda (African Region)¹², one from Sierra Leone (African Region)¹³ and one from Madagascar (African Region)¹⁵.

Regarding maternal factors associated with stunting in children under 2 years of age in these 15 studies, the most important factor was maternal education [100% (15/15) which showed mostly mothers had absolutely no education or less than Primary Education. The second most frequent factor was maternal age [66.66% (10/15)] ranging from 20-29 years. Maternal occupation [53.33% (8/15)] showed that majority of mothers were from working class and also maternal socio-economic status [53.33% (8/15)] showed all mothers belonged to poor class. Regarding maternal

parity [40% (6/15)], mothers had up-to 3 children and [40% (6/15)] mothers had up-to 3 ante-natal check-ups. As far as maternal nutritional status is concerned [33.33% (5/15)] majority mothers were under-weight with BMI <18.5 and regarding age-appropriate child's feeding [33.33% (5/15)] mothers had no awareness about it and did not practice it.

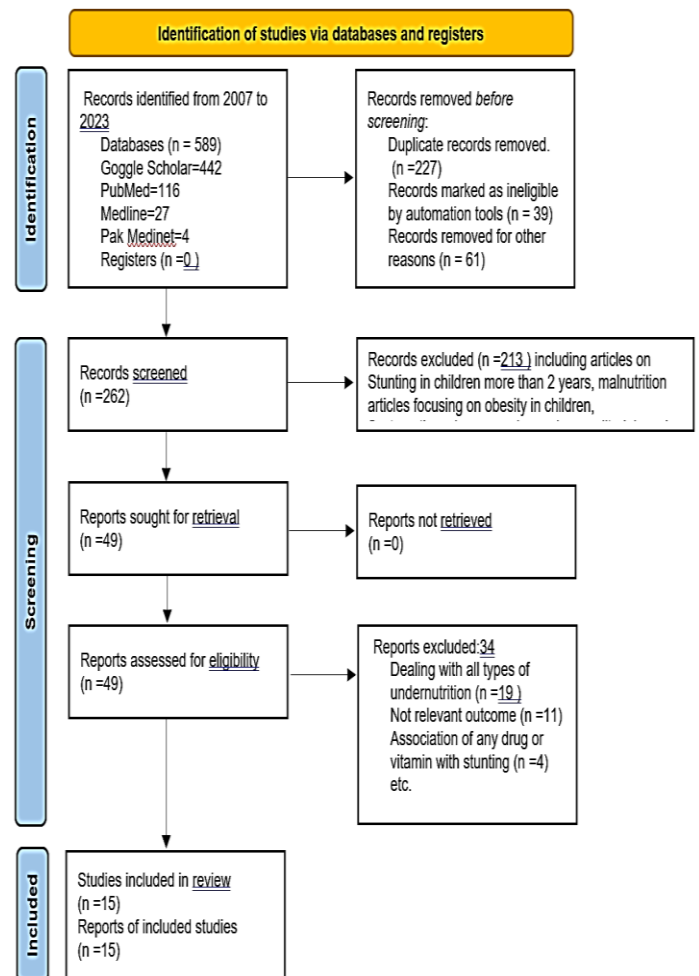


Fig.1: Flow diagram of literature search and study selection.

Table 1 – Characteristics of the Studies

SR#	AUTHOR	YEAR	AREA	S/S	STUDY DESIGN	STUNTING PREVALENCE	MALE/FEMALE RATIO	MATERNAL FACTORS							
								AGE	EDUCATION	OCCUPATION	NUTRITIONAL STATUS <18.5Under weight	PARITY	ANTE-NATAL CHECKUPS	AGE APPROPRIATE FEEDING	SOCIO-ECONOMIC STATUS
1	Sabuj Kanti Mistry et al. 8	2018	Bangladesh (Asia)	6539	C/S	29.90%	49:51 %	64% 20-29Y	38.74 % No Education	94.4% H.W	20.60%	-	-	-	40% Poor
2	Sushmita Das et al. 9	2020	India (Asia)	3578	C/S	38%	50:50 %		43% No Education	43% Working	-	57 % upto 3	46% < 4 Visits or None	40% No	41% Poor
3	Aisha Iftikhar et al. 10	2018	Pakistan (Asia)	228	C/S	40.40%	64.5:35.5 %	26 +- 5 Years	56.1 % No Education	-	-	42% upto 3	0	0	0
4	Christiana R. Titaley et al. 11	2019	Indonesia (Asia)	24,657	C/S	33.70%	50:50 %	36.6% < 20 yr	36.9% No Education	35.2% Working	-	0	39.6% < 3 Visits or None	0	40.9% Poor
5	Zeweter Abebe et al. 12	2016	Ethiopia (Africa)	122	C/S	50%	51.6:49.4 %	26 +- 6.1 yr	63.1% No Education	-	12.30%	0	66.4% > 3 Visits	30% No	-
6	Sakina Makatita & Ratna Djuwita. 13	2019	Indonesia (Asia)	500	C/S	39.20%	-	26 YR	75.20 % < Secondary	-	0	77.80% upto 3	0	55.4% No	-
7	Sumiaty Sumiaty et al. 14	2019	Indonesia (Asia)	65	C/S	26.20%	-	-	17% < Primary	-	23.10%	59% upto 3	10% No	-	-
8	Harriet Torlesse et al. 15	2016	Indonesia	1366	C/S	28.40%	50.4:49.6 %	51.5% 20-29 YR	43.4% No Education	-	-	-	40.7 % < 4 visits	31.3 % No	21.5% Poor
9	Beruk Berhanu Desalegn et al. 16	2016	Ethiopia (Africa)	312	C/S	44%	50.3:49.7 %	60 % < 21 YR	97.8% < Secondary	92.3% H.W	0.00%	-	88% < 3 visits	20% No	-
10	Lenni Silas et al. 17	2018	Mimika (Asia)	100	C/S	32.20%	-	87% 20-35 yr	36% < Primary	38.9% Working	-	-	-	-	39% Poor
11	A Mittal et al. 18	2007	India	482	C/S	46%	51:49%	42% 21-25 yr	67% No Education	8.1 Working	0.00%	-	-	-	-
12	Vestine Uwiringiyimana et al. 19	2022	Rawanda (Africa)	3593	C/S	38%	49.2:50.8 %	-	70% < Primary	-	6.10%	-	-	-	46.8% Por
13	Quraish Serwanja et al. 20	2019	Sierraleone (Africa)	4045	C/S	32%	-	68.4% 20-34 yr	65.8% No Education	84.5% Working	-	53.9% upto 3	-	-	38% Poor
14	Mohaimen Mansoor et al.21	2021	Bangladesh (Asia)	6179	C/S	28.30%	51.3:48.7%	-	50.1% No Education	39.9% Working	45.60%	43.4% upto 3	-	-	51.3% Poor
15	Mohaimen Mansoor et al.22	2023	Madagascar (Africa)	391	C/S	69%	49:51%	-	53% < Primary	-	-	-	-	-	-

S/S: Sample size C/S: Cross-sectional

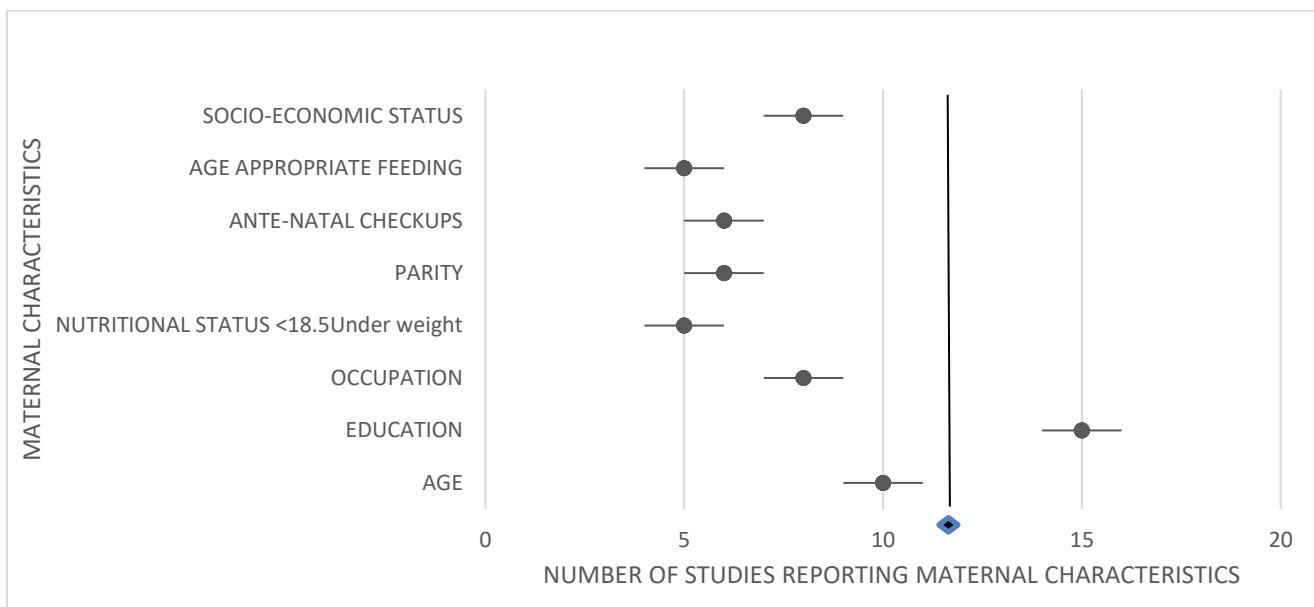


Figure 2: Forest Plot

DISCUSSION:

Stunted growth is the most prevalent manifestation of childhood malnutrition. This systematic review was done to describe maternal characteristics associated with stunting syndrome in children under-two years of age in Developing countries including African and Asian Regions of world.

Fifteen out of 15 studies (100%) showed that no or less mother’s education is highly prevalent predictor related to stunted growth in children under 2 years of age and it has been determined from the previous studies the importance of children growth retardation and mother’s education. One study in Indonesia found that

maternal education is a significant risk factor for childhood stunting, with an odds ratio (OR) of 1.9. This means that children whose mothers did not complete high school are at a 1.9-fold increased risk of developing a growth disorder compared to those whose parents did²³. The level of education attained by mothers has been found to broaden their understanding and awareness in areas such as food, nutrition, childcare, feeding methods, and ultimately the overall well-being of their children.

Maternal age ranges from 20-29 years in 66.66% of included studies showed that age plays pivotal role in stunting under 2 years. One study conducted in Pakistan demonstrated that the Scaling Up Nutritional Movement (SUN) aims to synchronize endeavors in enhancing the nourishment of mothers and their infants during the crucial initial 1000-day period, recognized as pivotal for nutritional enhancement. The first 1000 days after giving birth are called the "second window of opportunity" for mothers to improve their nutrition. The implementation of multi-sectoral nutritional strategies has contributed to the achievement of specific targets set by the World Health Assembly (WHA) in the context of adolescent nutrition. The primary objective is to achieve a 40% reduction in stunting rates, as there is a correlation between adolescent pregnancies and an increased risk of small for gestational age (SGA), low birth weight (LBW), preterm deliveries, and subsequent stunting during childhood.²⁴

Another important predictor in the study was maternal occupation with 53.33%. A study conducted in Kawai revealed that the presence of working mothers may potentially hinder their ability to adequately attend to

their children due to limited time availability. Consequently, this circumstance may provide a risk factor for children's susceptibility to stunting. Mothers play a crucial influence in shaping their children's futures. Children will benefit from having mothers who are well-informed about nutrition, who are emotionally available to them, and who model healthy habits during their children's formative years.²⁵

Socioeconomic status, one of the important predictors in the study with 53.33% showed that poor class has a high prevalence of retarded growth in children under 2. According to one study done in Nairobi, Kenya, 68% of stunted infants under the age of 2 were in the poorest household and 57% of children in poor households were stunted. Chronic malnutrition in childhood manifests as stunted growth.²⁶ In this respect, one's socioeconomic standing is crucial.

In this systematic review, another important factor was mother's Parity (up-to 3 children) was 40%. A study conducted in Indonesia revealed a significant association between multiple parity/grand multipara and a reduced likelihood of exclusive breastfeeding, as well as a shorter length of nursing. These factors were found to contribute to the occurrence of stunting in children below the age of 2. The cultural and religious context creates a situation where mothers face limited agency in making decisions regarding their reproductive health and determining the level of parity deemed acceptable for themselves. The maternal health is influenced by the number of children, and enhancing family support in relation to health might serve as a viable health promotion tool for women.²⁷

Another important factor in the study was Ante-natal

check-ups (ANC) up-to or less than 4 visits during that particular pregnancy were 40%. A recent study highlighted maternal and newborn mortality as two of Pakistan's most pressing public health issues. In the context of Pakistan, it is observed that a mere 40% of pregnant women have had the privilege of receiving ante-natal care within health institutions. Significant efforts are necessary to ensure the provision of enhanced healthcare services for women of reproductive age, with the aim of preventing maternal health issues. Additionally, it is imperative to prioritize the well-being of children throughout the critical first 1000 days of their lives.²⁸

Talking about the nutritional status of the mothers, 33.33% mother were under-weight with BMI < 18.5. The issue of malnutrition continues to be a significant public health concern in Pakistan. A study done in Rawalpindi yielded findings indicating that 20% of female participants possessed a body mass index (BMI) below the threshold of 18.5. The data that is currently accessible indicates that the primary nutritional challenges within the country consist of low-birth-weight infants resulting from inadequate maternal nutrition, protein energy malnutrition, and anemia across different demographic groups and geographical regions. The ongoing evaluation of nutritional status and the surveillance of micro and macronutrient deficiencies in the population, particularly among adolescent females, is imperative at present. These studies possess the potential to stimulate critical thinking among government policymakers. The utilization of nutritional education and health promotion can serve as a means to enhance the overall health condition of a

population.²⁹

Age-appropriate feeding is another important factor with 33.33% in our study. The optimal growth and development of a child is contingent upon the maintenance of a well-balanced diet. A study conducted in Pakistan revealed that under-nutrition is widely recognized as the primary cause of newborn morbidity and mortality on a global scale. This condition renders children more susceptible to many infectious diseases, including pneumonia and diarrhea. The adverse effects encompass impeded physical development, diminished muscle strength, and decreased bone density, ultimately resulting in reduced daily functional capacity.³⁰ Another study found that in Indonesia, 27.5% of children between the ages of 6 and 24 months had development retardation, and 54.1% of these children had not been exclusively breastfed after birth and it is an established fact that exclusive breastfeeding is a protective factor against stunting.³¹ The transition to solid foods during the weaning stage is crucial to the development and health of infants. Many potential health problems in infancy can be avoided if the right meals are introduced at the right time. It is imperative that mothers have information regarding the weaning process. This covers information such as when to start weaning, what to feed your baby, how often to feed them, and how much food they can handle. Infants' nutritional status is affected by all these factors.³²

The risk of information bias may have been heightened in these studies due to variations in sample size, sampling methods, and outcome measurement tools. A review of the literature indicates that stunted growth is influenced by maternal factors. Future research should

delve into these factors to enhance efforts in preventing and managing childhood growth restriction. The next step, based on this research, is to establish new community-based nutrition programs and upgrade existing nutrition plans to deal with this issue on a community level, while also educating and counseling parents on proper feeding practices for their children.

CONCLUSION:

In this systematic review, regarding maternal factors associated with stunting in children under 2 years of age in these 15 studies, the most important factor was no or less maternal education 100 %, second most frequent factor was maternal age 66.66% ranging from 20-29 years. Maternal occupation showed 53.33% of mothers were from working class and socio-economic status 53.33% showed all mothers belonged to poor class. Regarding maternal parity 40% of mothers had up-to 3 children and 40% mothers had up-to 3 antenatal check-ups during pregnancy. As far as maternal nutritional status is concerned 33.33% mothers were under-weight with BMI <18.5 and regarding age-appropriate child's feeding 33.33% mothers had no awareness about it and did not practice it. The maternal characteristics and stunting syndrome in this study can be used as informational material for the implementation of preventive and control measures effectively to address this issue.

ACKNOWLEDGMENTS:

We would like to express our sincere gratitude and appreciation to Dr. Fatah Shahzad, Dr. Saira Afzal for their unwavering support and assistance in this research work. Their valuable guidance and input have been instrumental in ensuring the success of our

publication. We are truly grateful for their contributions.

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