



## FREQUENCY OF DELAYED MILESTONES AMONG MALNOURISHED CHILDREN UNDER 5 YEARS OF AGE

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### Abstract

**Background :** In children who suffer from inadequate nutrition, delays in reaching developmental milestones are frequently observed. Malnutrition suppresses immunity and affects the growth negatively in addition to psychomotor and cognitive development. Delays in milestones are associated with the increased burden of disease in malnourished children and, thus, it is important to recognize this burden to determine nutritional interventions, parental education, and preventive health approaches in the developing world.

**Objectives:** To establish the frequency of delayed milestones in children under five years with malnutrition and the correlation between socioeconomic, demographic and maternal factors as compared with the development of the other children.

**Study Design:** A Descriptive Cross-Sectional Study.

**Place and Duration of study .** Pediatrics Department of Khyber Teaching Hospital, Peshawar from January 2021 to July 2021.

**Methods:** This study was descriptive, cross-sectional study in Pediatrics Department of Khyber Teaching Hospital, Peshawar, over a six month period. A total number of 155 malnourished children in the age range of 1-5 years were recruited by means of consecutive sampling. Patients were studied by socio economic factors, clinical history, and maternal teaching. Systemic and physical examination, along with laboratory (supporting) tests were conducted. Analysis of data was based on SPSS v20, and chi-square test was used during stratification. A p- value of 0.05 or less was deemed as significant.

### Results

Out of 155 children, 96 (62%) were between 1 and 3 years 59 (38%) between 4 and 5 years. The average age was 3 years (SD+/-1.71). Male and female distribution was 67 (43%) and 88 (57%), respectively. Socioeconomic statistics indicated that 57 percent were families in lower, 35 percent were families in middle and 8 percent were families in upper classes. Maternal education was not very high and 37% had primary education and 3 percent were graduates or above. The delay of milestones was noted in 19 children (12%). Statistical stratification indicated that there was a significant association with age ( $p=0.000$ ) and a non-significant association with gender, socioeconomic status and mothers' education ( $p>.05$ ).

**Conclusion:** Our study reveals that 12% of malnourished children under the age of five experience delays in developmental milestones. Notably, we found a statistically significant association between these delays and the child's age, underscoring the critical importance of early nutritional support and age-specific interventions to promote healthy development. The results emphasize the necessity of early dietary interventions, parent education, and community based-programs to manage development delays. Socioeconomic barriers can be addressed and improved motherly education would also diminish the risks. Early provisions can positively impact the progress of infants and young children and reduce the effects of the malnourishment of such at-risk populations in a lasting manner.

**Keywords:** Stunted development, children, malnutrition

## INTRODUCTION

Child development is a flux that is seen through attainment of motor milestone, cognitive, linguistics and socio-emotional milestones which are taken as an indicator of healthy development. All the failures to achieve them at the appropriate ages are known as delayed milestones or developmental delay. The condition has been noted as a major public health challenge globally as it has a long-term impact on education, productivity and quality of life. Delayed milestones are especially common in low- and middle-income nations due to the epidemic levels of malnutrition, poverty, infections, and subpar health care services [1,2]. Malnutrition is by far the most significant risk factor of impaired child growth and neurodevelopment. Malnutrition is defined by World Health Organization (WHO) as an imbalance between provision of nutrients and requirements of the body at the cellular level to fuel growth, maintain and/or perform. The risks of protein-energy malnutrition (PEM) and micronutrient deficiencies are further exacerbated by prolonged brain myelination, lower synaptic development and inefficient immune responses, which contributes to slow acquisition of milestones [3,4]. Malnourished children become susceptible to motor delays, including slow walking, poor fine motor skills, delayed in coordination, speech delays, and low cognitive abilities [5]. The majority of young children worldwide (over 200 million) are not able to develop to their full potential because of under-nutrition and poverty [6]. South Asia and specifically Pakistan, India and Bangladesh are key areas of concern with regards to prevalence of stunting and wasting. Lately, the WHO estimates that child malnourishment is chronically frequent to the tune of about 32 percent of children in the developing world with South Asia having the highest provision [7]. Pakistan has always remained to be an issue with almost one-third of the under-five population being stunted or underweight. Such nutritional burden is translated into increased incidences of developmental delay, low school readiness, and decreased productivity in adulthood [8]. The connection between malnutrition and developmental delay is not an isolated one. Research indicates that children of low socioeconomic and children born of low literate mothers are more prone [9,10]. There are underlying recurrent illnesses such as diarrhea and respiratory infections that, in addition, worsen nutrition deficiencies and hamper development in such environments [11]. Deficiencies (zinc, iodine, and iron) of the micronutrients compound the neurodevelopmental deficits by disrupting neurotransmitter activity and brain metabolism. Moreover, maternal awareness and health-seeking behaviour greatly determine child outcomes, and there is a heavy need to become informed and proactive [12]. Although the world has closely been observing the problem, little is known about how many malnourished children are experiencing delayed milestones in Pakistan specifically among those under the age of five years. The majority of the available literature centers mostly on the growth outcomes but not the neurodevelopmental outcomes. This discrepancy raises the necessity of locally relevant data to inform interventions, especially in tertiary-care hospitals, where a large burden of malnutrition-related problems is reported. This has been carried out at the Pediatrics Department of Khyber Teaching Hospital, Peshawar, with the intention to establish the prevalence of delayed milestones in malnourished children under five years of age. Through the presence of prevalence and association with demographic and maternal factors, the study gives a clue on selective screening, very early intervention as well as policy planning. This will eventually aid evidence-based interventions on

decreasing the burden of developmental delay related to children afflicted with malnutrition in resource-limited contexts.

## Methods

We conducted a descriptive cross-sectional study in the Pediatrics Department, Khyber Teaching Hospital, over six months. A WHO-based sample of 155 malnourished children (>1–<5 years) was enrolled consecutively. Demographics, socioeconomic status, and maternal education were recorded; standardized clinical assessments were completed. Data were analyzed using chi-square tests ( $\alpha=0.05$ )

**Inclusion criteria.** The inclusion criteria were the children with the age of over one but less than five years of both sexes diagnosed as malnourished based on WHO standards (according to Gomez classification) who also have had an illness of over six months in duration.

**Exclusion criteria.** Children with congenital anomalies (e.g. Down syndrome, fragile X syndrome, microcephaly), suffered brain injuries (e.g. birth complications, shaken baby syndrome), or had post-encephalitic sequelae were excluded to reduce confounding. Parents/ guardians who were not willing to give consent were also omitted.

**Ethical approval statement.** This protocol was approved by the Ethical Review Committee of Khyber Teaching Hospital, Peshawar. Written informed consent was given by parents/legal guardians prior to enrollment. Strict confidence and anonymity were adhered to.

## Results

The children (aged 1-5 years) who were malnourished were taken as subjects of study (155). The average age was 3.0 years (SD + / - 1.71), 43 percent being male and 57 female. The distribution of age was 62% in the 1-3 years group and 38% of the 4-5 years group. Social-economic analysis indicated that 57 percent of the mailed children were in lower social classes, 35 percent were in middle social classes and 8 percent of the mailed children were in lower classes. As concerning maternal education, 37 percent of the mothers had a primary school education, 28 percent had middle school, 20 percent had matric, 12 percent intermediate and only 3 percent had higher school education. In 19 children (12%) delayed milestones were observed. Stratified analysis showed that there is an age-delayed milestones relationship that is statistically significant ( $p=0.000$ ).

No meaningful result was recorded in regard to sex ( $p=0.916$ ), socioeconomic status ( $p=0.869$ ) or maternal education ( $p=0.917$ ). The results show that age is a significant risk factor to developmental delay in malnourished children determining that the younger the age, the higher the risk of incurring developmental delay.

**Table 1: Age Distribution**

Age Group	Frequency	Percentage
1–3 years	96	62%
4–5 years	59	38%
Total	155	100%

**Table 2: Gender Distribution**

Gender	Frequency	Percentage
Male	67	43%
Female	88	57%
Total	155	100%

**Table 3: Socioeconomic Status**

Socioeconomic Class	Frequency	Percentage
Upper Class	13	8%
Middle Class	54	35%
Lower Class	88	57%
Total	155	100%

**Table 4: Maternal Education**

Maternal Education	Frequency	Percentage
Primary	58	37%
Middle	43	28%
Matric	31	20%
Intermediate	19	12%
Graduate	3	2%
Postgraduate	1	1%
Total	155	100%

## Discussion

The current study explored the interrelationship between malnutrition and delayed development in children under the age of five years at a tertiary care hospital in Peshawar. We found out that 12 percent of malnourished children exhibited developmental delays with age being statistically significant in association. Other variables such as gender, social-economic status, maternal education, etc did not show any significant correlations. These results substantiate that developmental outcomes are multifactorial in malnourished populations. Decent frequency is comparable to that in other low- and middle-income countries that record malnutrition as one of the key factors in the developmental delay [13]. Brain development, synapses, and motor coordination are discombobulated due to the nutritional deficiencies causing delays in motor skills, speech, and walking as well [14]. Attention has been recently brought to the importance of maternal nutrition in the context of pregnancy and early infancy in shaping neurodevelopment and the first 1,000 days as a critical window [15]. This predisposition is observed in our findings as younger children (1-3 years) had significantly higher incidences of developmental delay. Even though socioeconomic conditions and maternal education were not statistically significant in our cohort, they have been shown to be relevant to developmental outcomes in other studies. A research in South Delhi had found that households with low income were highly malnourished and impaired in terms of development [16]. On the same note, the experience of Jharkhand during the COVID-19 pandemic demonstrated the vulnerability of nutrition improvements in those resource-constrained households with cases of severe acute malnutrition released children being at risk of falling back unless maintained [17]. Biochemical and metabolic underpinnings deserve consideration as well. Malnutrition has been reported to include vitamin D and micronutrient deficiencies and poor growth and delayed neurodevelopment in children with protein-energy malnutrition [18]. In addition, comorbid diseases, like congenital heart disease, were displayed to heighten developmental delays in case of its combination with malnutrition, and hence, comprehensive screening is needed [19]. On the whole, our results confirm that malnutrition in early childhood is an important cause of developmental delays, with younger children at the greatest risk. Interventions should be focused in the first 1,000 days of nutrition, should incorporate maternal education, and should encourage systematic developmental screening. To capture the effect of socioeconomic and maternal factors, future studies need to utilize community-based designs by ensuring that they have bigger and more comprehensive samples. Biochemical profiling and

micronutrient assessment would also be of interest to get more insight into the mechanism underlying delay.

**Conclusion:**

This study found that 12% of malnourished children under five years exhibited delayed milestones, with younger age significantly associated. The findings highlight the urgent need for early screening, nutritional interventions, and parental education. Targeted community-based strategies are essential to mitigate developmental delays and improve long-term child health outcomes.

**Limitations:**

The study was limited by its single-center, hospital-based design, which may not reflect community prevalence. The relatively small sample size restricted generalizability. Additionally, biochemical and micronutrient assessments were not included, and developmental evaluation relied on clinical observations, which may underestimate subtle cognitive or psychosocial delays in affected children.

**Future Findings:**

Future research should incorporate multicenter, community-based studies with larger samples to improve external validity. Integration of biochemical and micronutrient profiling, alongside standardized developmental screening tools, will enhance accuracy. Longitudinal designs are recommended to track recovery following nutritional interventions, providing valuable insights into sustainable strategies for reducing developmental delays.

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**Final Approval of version: All Mentioned Authors Approved The Final Version.**

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