

Risk factors for Postnatal Growth Failure in Premature babies less than 32 weeks at Neonatal Care Unit

*Jamal Mohammed Hussein¹, Alan Abdullah Abdulrahman^{2,3,4}

1. Pediatrician Lecturer, Clinical Science Branch, College of Medicine, University of Sulaimani, Kurdistan Regional of Iraq.
2. Assistant Professor in Pediatric and Consultant Neonatologist, Branch of Clinical Sciences, College of Medicine - University of Sulaimani, Kurdistan Regional of Iraq.
3. Chief Of Sulaimani Dr. Jamal Ahmed Rashid Pediatric Hospital NICU, Program director of Neonatology Subspeciality – KHCMS, Director of Sulaimani Neonatology Subspeciality Center.
4. Chief of Anwar Shekha Medical city NICU, Sulaymaniyah City/ Kurdistan Region/ IRAQ.

ARTICLE INFO	ABSTRACT
<p>Article type: Original Article</p> <hr/> <p>Article History: Received: 6 Dec 2025 Accepted: 5 Jan 2026</p> <hr/> <p>Key words: Preterm infants, Postnatal Growth Failure, Enteral feeding, Human milk fortification, Total parenteral nutrition</p>	<p>Introduction: This study aimed to establish the prevalence and the risk factors of PGF in preterm babies under the Neonatal Intensive Care Unit (NICU) of Dr. Jamal Ahmed Rashid Pediatric, and Maternity Teaching Hospitals, Sulaimaniyah, Iraq.</p> <p>Material and Methods: The cross-sectional prospective design was used. The participants included preterm cases who were born at 32 weeks of gestation or below and were taken to the NICU at birth and up to two months of corrected age. The electronic clinical records were used to extract data, which consisted of maternal demographics, neonatal characteristics, feeding practices, and clinical complications. The anthropometric indices (weight, length, head circumference) were recorded at birth, 36 corrected gestational age (CGA), two months corrected age. A p-value<0.05 was considered statistically significant.</p> <p>Results: PGF was found in 70.4% of infants at 36 weeks CGA and continued at 46.3% at two months corrected age. Strong inverse associations between PGF and the birth weight ($r = -0.482$, $P < 0.001$) and earlier initiation of enteral feeding ($r = -0.394$, $P = 0.003$) and between PGF and the gestational age ($r = -0.300$, $P = 0.028$) were observed. Correlations with positive values were observed between PGF and necrotising enterocolitis (NEC; $r = 0.305$, $P \leq 0.025$), total parenteral nutrition (TPN) utilisation ($r = 0.327$, $P \leq 0.016$), prolonged time to full enteral feeding ($r = 0.453$, $P \leq 0.001$). There was a significant nutritional deficiency as human milk fortification (HMF) was missing in all the cases.</p> <p>Conclusions: Strong feeding guidelines, regular HMF, and improved post-discharge follow-up may significantly improve the developmental patterns and health outcomes in preterm population.</p>
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*Corresponding author: E-mail: Jamal.lateef@univsul.edu.iq

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Introduction

Postnatal growth failure (PGF) is defined as a weight at discharge below the 10th percentile for postmenstrual age. Although length and head circumference provide valuable information on longitudinal and neurologic growth, weight is widely accepted as the primary outcome for assessing postnatal growth failure in the acute neonatal period due to its responsiveness to nutritional intake and metabolic status. Among premature infants, the prevalence of PGF is over 50% (1). Small for gestational age infants had less weight gain than infants of appropriate weight for gestational age, and small for gestational age infants weighed less by the age of 3 to 6 years (2). Globally, about 15 million premature babies are born each year, with a gestational age of less than 37 weeks (3). One in every 10 babies born in the world is premature (4). Although the survival rate of premature infants has increased in recent decades due to the development of prenatal and neonatal medical sciences, these infants are at risk of growth restriction, delayed motor and language development in later stages of life (5). Inadequate growth after birth can be defined and diagnosed in a number of ways. Extruterine growth restriction (EUGR) is a static, cross-sectional method that refers to a weight deficit below a certain percentile (tenth or third) or z-score of expected growth at a specific time, usually at discharge from the neonatal intensive care unit (NICU) (6). In premature infants, growth retardation is diagnosed when the infant's weight, height, or head circumference growth slows so that it is not approximately parallel to a percentile during the established growth period (7).

Small for gestational age (SGA) is defined as weight, height, and head circumference less than the 10th percentile for gestational age (GA) (8).

Premature infants with PGF are at increased risk of respiratory distress after discharge from the hospital. These infants are susceptible to physical dysplasia in the short term and face long-term problems such as high blood pressure in adolescence, metabolic and endocrine abnormalities, and impaired neurodevelopment that may affect their quality of life (9, 10). Factors affecting

post-discharge growth and development in premature infants include gestational age, weight, length of hospital stay, presence of sepsis, respiratory distress syndrome (RDS), and bronchopulmonary dysplasia (BPD) (11). Growth failure is a serious problem in premature infants, and it is crucial to investigate the factors affecting growth failure in premature infants and reduce its occurrence (12). Studies have shown that 16% of extremely low birth weight (ELBW) infants are SGA at birth, but by 36 weeks corrected age, about 89% have growth failure, indicating a high rate of poor postnatal growth during NICU stay (13).

Although several factors such as low birth weight, inadequate nutrition, comorbidities, and length of stay in the NICU have been identified as potential risk factors for PGF, the exact pattern of these factors varies across regions due to differences in demographics, resources, and treatment protocols. In Sulaymaniyah, Iraq, accurate and evidence-based information on the prevalence of PGF and its associated risk factors is limited.

The lack of such information hinders the design of effective interventions to prevent this condition and improve developmental outcomes in this vulnerable group. Identifying risk factors affecting postnatal growth failure in premature infants hospitalized in Sulaymaniyah neonatal care units is an urgent necessity to improve neonatal care and reduce long-term complications. Therefore, we aimed to evaluate Risk factors for Postnatal Growth Failure in Premature babies in Neonatal Care Unit of Dr. Jamal Ahmed Rashid Pediatric Teaching Hospital.

Material and Methods

Study setting

This study was done at the neonatal care Unit of Dr. Jamal Ahmed Rashid Pediatric Teaching Hospital and the Maternity Teaching Hospital, Sulaimaniyah, Iraq. They are both tertiary care facilities that provide specialised care to a wide range of paediatric and neonatal cases. Their neonatal care units are big referral centres in the area with the right equipment to handle high-risk pregnancies and premature babies who require an intensive care unit.

Study design

The study assumed a prospective, cross-sectional design. It was done to determine and assess possible risk factors that could have been related to PGF in premature infants at the neonatal care unit of Dr. Jamal Ahmed Rashid Pediatric Teaching Hospital and Maternity Teaching Hospital. This design was chosen because it will be easy to analyse the pre-existing hospital records and clinical data during a period of time.

Study population

The research population was the premature newborns born at or below the 32 gestation weeks and admitted to the neonatal care unit immediately after delivery and monitored to the completion of the initial two months of their life. The selection of all eligible cases was done according to the records of hospital admissions in the study period. The infants that were born at or below 32 gestational weeks and taken to Maternity Teaching Hospital or to the Dr. Jamal Ahmed Rashid Neonatal Care Unit were included in the study. Preterm babies having significant congenital/gastrointestinal defects, infants who had severe cardiac disease or perinatal asphyxia, excluded from study. All enrolled infants underwent routine clinical and ultrasonographic screening for major congenital and gastrointestinal anomalies during the first 72 hours of admission; none were identified beyond a single case of minor congenital anomaly (not affecting feeding), which was retained in the analysis.

Data collection

The data were obtained in patient case files and electronic medical records that were maintained by the hospitals. The data gathered included demographic and clinical features of the mothers and the infants, as well as components of detailed information on the neonatal care practices.

The weight, length, and head circumference were measured at birth, 36 weeks corrected age and two months of corrected age. Nutritional information included the nature and timing of feeding; breast milk, formula feeding or parenteral nutrition, and a documented feeding intolerance or nutritional interventions. Further data involved statistical data on the utilization of medical therapies, respiratory care,

readmission rates, and instances of infection or other complications in the neonatal stage.

Notably, human milk fortification was not practiced in any case, as fortifiers were unavailable in the study hospitals during the data collection period due to supply limitations and lack of institutional protocols guiding their use.

Ethical consideration

This study was given ethical approval by the University of Sulaimani Ethics Committee (Reference No.381 on November 17th 2024). The data of all patients were made anonymous and the personal identifiers were eliminated before analysis to maintain confidentiality. The study was conducted in relation to the ethical principles of institutional and national research guidelines with reference to using clinical data in conducting research.

Statistical analysis

The SPSS software (version 28.0) was used to analyze the data. The socio-demographic, maternal and neonatal characteristics are summarised using descriptive statistics in the form of means, standard deviation, and frequency distributions. The Chi-square test was used to test associations between categorical variables.

The comparative analyses were done to find the patterns of growth and also to find the factors affecting the postnatal growth outcomes of the preterm infants. The statistical significance was considered at p-value less than 0.05.

Results

As shown in Table 1, most mothers (70.4%) were between 20 and 34 years of age, and over one-third (38.9%) had completed tertiary education. The majority (74.1%) reported having an adequate socioeconomic status. Antenatal complications were common, affecting 59.3% of pregnancies, with premature rupture of membranes (24.1%) and preeclampsia (9.3%) being the most frequently reported conditions.

Antenatal corticosteroid therapy was administered in 68.5% of cases, and none of the mothers reported smoking during pregnancy. Cesarean section was the predominant mode of delivery, performed in 70.4% of births.

Table 1. Maternal sociodemographic characteristics, antenatal history, and delivery-related factors

Variable	Category	n (%)
Maternal age (years)	<20	1 (1.9)
	20–34	38 (70.4)
	≥35	15 (27.8)
Maternal education	No formal education	13 (24.1)
	Primary	12 (22.2)
	Secondary	8 (14.8)
	Tertiary	21 (38.9)
Socioeconomic status	Adequate	40 (74.1)
	Low	14 (25.9)
Antenatal complications	None	22 (40.7)
	PROM	13 (24.1)
	Preeclampsia	5 (9.3)
	Other*	19 (35.2)
Number of antenatal visits	<4	21 (38.9)
	4–8	32 (59.3)
	>8	1 (1.9)
Antenatal corticosteroids	Yes	37 (68.5)
	No	17 (31.5)
Maternal smoking during pregnancy	No	54 (100)
Mode of delivery	Cesarean section	38 (70.4)
	Vaginal	16 (29.6)
Kangaroo mother care (KMC)	Provided	35 (64.8)
	Not provided	19 (35.2)

* Includes chorioamnionitis, gestational diabetes, anemia, UTI, antepartum hemorrhage, APS, hypothyroidism.

The mean gestational age of the preterm cohort was 30.2 ± 1.8 weeks, with a mean birth weight of 1465.6 ± 395.7 g. More than half of the infants (57.4%) were classified as low birth weight, 31.5% as very low birth weight, and 11.1% as extremely low birth weight. Male infants accounted for 59.3% of the sample, and 38.9% were from multiple gestations.

Respiratory distress syndrome was highly prevalent, occurring in 94.4% of neonates, while necrotizing enterocolitis (NEC) was diagnosed in 7.4%.

Nearly half (48.1%) developed patent ductus arteriosus, and 61.1% experienced sepsis. Most infants (77.8%) had a neonatal intensive care unit (NICU) stay of less than

30 days. After discharge, 29.6% required hospital readmission—most commonly for poor feeding (11.1%), jaundice (9.3%), or sepsis (9.3%) (Table 2).

Feeding practices are summarized in Table 3. Enteral feeding was delayed beyond 24 hours after birth in 88.9% of infants. Only one in five infants (20.4%) achieved full enteral feeding within the first seven days of life, while 42.6% required more than 14 days. Feeding intolerance, manifested by vomiting, abdominal distension, or both, was observed in 74.1% of the cohort. Parenteral nutrition was required in 35.2% of infants. Importantly, none of the infants received human milk fortification during their NICU stay.

Table 2. Neonatal characteristics, major morbidities, and post-discharge outcomes

Variable		Category	n (%)
Gestational age (weeks)		<28	7 (13.0)
		28–32	47 (87.0)
Birth weight		<1000 g (ELBW)	6 (11.1)
		1000–1499 g (VLBW)	17 (31.5)
		1500–2500 g (LBW)	31 (57.4)
Sex		Male	32 (59.3)
		Female	22 (40.7)
Multiplicity		Singleton	33 (61.1)
		Twin	12 (22.2)
		Triplet or more	9 (16.7)
Apgar score (5 min)		0–3	3 (5.6)
		4–6	24 (44.4)
		7–10	27 (50.0)
Congenital anomalies		Yes	1 (1.9)
		No	53 (98.1)
Major neonatal complications		RDS	51 (94.4)
		BPD	9 (16.7)
		NEC	4 (7.4)
		Sepsis/infection	33 (61.1)
		PDA	26 (48.1)
		IVH (Grade IV)	1 (1.9)
NICU stay duration		<30 days	42 (77.8)
		30–60 days	11 (20.4)
		>60 days	1 (1.9)
Feeding difficulty at discharge		Yes	1 (1.9)
		No	53 (98.1)
Post-discharge readmission		Yes	16 (29.6)
		No	38 (70.4)
	Jaundice	5 (9.3)	5 (9.3)
	Poor feeding	6 (11.1)	6 (11.1)
	Sepsis	5 (9.3)	5 (9.3)

Table 3. Feeding practices, tolerance, and nutritional support during NICU stay

Variable		Category	n (%)
Time to first enteral feeding		Within 24 hours	6 (11.1)
		>24 hours	48 (88.9)
Time to full enteral feeding		<7 days	11 (20.4)
		7–14 days	20 (37.0)
		>14 days	23 (42.6)
Feeding intolerance		None	14 (25.9)
		Vomiting only	10 (18.5)
		Abdominal distension only	1 (1.9)
		Both	29 (53.7)
Parenteral nutrition use		Yes	19 (35.2)
		No	35 (64.8)
Human milk fortification (HMF)		Yes	0 (0.0)
		No	54 (100.0)

Anthropometric data are presented in Table 4. Mean body weight increased significantly from 1465.6 ± 395.7 g at birth to 4529.6 ± 791.2 g at two months' corrected age ($P < 0.001$). At 36 weeks' corrected gestational age (CGA), 70.4% of infants had a weight below the 10th percentile, meeting criteria for postnatal growth failure (PGF).

This proportion decreased to 46.3% by two months' corrected age, suggesting partial catch-up growth.

At 36 weeks CGA, 40.7% of infants had a length below the 10th percentile, while only 7.4% had a head circumference below this threshold (Table 4).

Table 4. Growth patterns and anthropometric measurements

Measure	Timepoint	Mean \pm SD	<10th percentile (%)	10th-50th (%)	>50th (%)
Weight (g)	Birth	1465.6 \pm 395.7	—	—	—
	36 weeks CGA	2025.9 \pm 550.5	38 (70.4)	9 (16.7)	7 (13.0)
	2 months CA	4529.6 \pm 791.2	24 (44.4)	21 (38.9)	9 (16.7)
Length (cm)	Birth	40.2 \pm 2.1	—	—	—
	36 weeks CGA	—	22 (40.7)	21 (38.9)	11 (20.4)
	2 months CA	56.0 \pm 3.0	—	—	—
Head circumference (cm)	Birth	28.3 \pm 1.8	—	—	—
	36 weeks CGA	32.4 \pm 1.7	4 (7.4)	28 (51.9)	22 (40.7)
	2 months CA	38.2 \pm 2.0	—	—	—
P-value*	—	<0.001 (weight), <0.001 (HC)	—	—	—

* Based on repeated-measures ANOVA. Length at birth mean calculated from available data (original itemized values omitted for conciseness).

As detailed in Table 5, postnatal growth failure demonstrated significant negative correlations with birth weight ($r = -0.482$, $P < 0.001$), gestational age ($r = -0.300$, $P = 0.028$), and earlier initiation of enteral feeding ($r = -0.394$, $P = 0.003$). Conversely, PGF was positively associated with the presence of NEC ($r = 0.305$, $P = 0.025$), use of total parenteral nutrition ($r = 0.327$, $P =$

0.016), longer time to achieve full enteral feeding ($r = 0.453$, $P < 0.001$), and post-discharge hospital readmission ($r = 0.374$, $P = 0.005$). No statistically significant associations were found between PGF and maternal education, socioeconomic status, mode of delivery, or provision of kangaroo mother care.

Table 5. Correlations between postnatal growth failure and clinical variables

Variable	Correlation coefficient (r)	P-value
Maternal age	-0.266	0.052
Gestational age	-0.300	0.028
Birth weight	-0.482	<0.001
Time to first enteral feeding	-0.394	0.003
Necrotizing enterocolitis (NEC)	0.305	0.025
Total parenteral nutrition use	0.327	0.016
Time to full enteral feeding	0.453	<0.001
Post-discharge readmission	0.374	0.005
All other variables (e.g., education, sex, RDS, PDA, KMC)	*	P

Discussion

The results were that PGF was high in this cohort. In particular, 70.4% of infants had a weight below the 10th percentile at 36 weeks of corrected gestational age (CGA) but the proportion decreased to 46.3% at 2 months of corrected age indicating some

partial recovery. This was determined by correlation analysis which found that birth weight and time of first feeding were protective factors and thus showed the significance of both biological maturity and early nutritional support in facilitating development of preterm infants. On the

other hand, there were various clinical and management-related elements that were strongly linked with the higher risk of PGF. These were long period to full enteral nutrition, total parenteral nutrition (TPN), incidence of necrotising enterocolitis (NEC), and discharge readmission. These results, together, highlight the multifactoriality of growth failure which may be not only caused by the biological immaturity of an infant, but also by the nature and stability of neonatal care. PGF prevalence in this study 70.4% at 36 weeks CGA and 44.4% at two months corrected age is consistent with the other low- and middle-income countries, whereby inadequate resources and structural impediments in neonatal care lead to poor growth outcomes. In a study carried out in Uganda on infants with a weight below 1500 grams, the incidence of PGF at discharge was reported to be 75.9 % as compared to ours that is slightly higher. The authors ascribed this high rate to the late commencement of enteral nutrition and limited nutritional care in scenarios where resources were limited (14). In contrast, a study conducted by Lyu et al. (2022) in China reported a markedly lower prevalence of PGF with only 19.9% of very preterm infants affected (15).

This disparity is likely indicative of enhanced availability of sophisticated nutritional interventions and the establishment of standardized feeding protocols within Chinese NICUs. In a parallel investigation, Rohsiswatmo et al. (2023) in Indonesia operationalized the definition of PGF utilizing a weight-for-age Z-score threshold of less than -1.28 at the time of discharge, reporting prevalence rates that fluctuated between 25% and 60%, contingent upon the specific cutoff utilized (16). The prevalence identified in the current study resides within this intermediate spectrum, underscoring the necessity for the enhancement of nutritional protocols within neonatal units in Iraq and other analogous resource-constrained environments, wherein economic limitations and limited access to specialized neonatal healthcare significantly influence outcomes. In this study setting, the absence of human milk fortification, delayed initiation of enteral feeding due to limited monitoring capacity, and reliance on

unfortified maternal milk or standard formula without protein supplementation likely contributed to the high prevalence of growth failure, reflecting systemic gaps in specialized neonatal nutrition services.

From a maternal standpoint, this investigation revealed a weak yet statistically significant inverse correlation between maternal age and PGF, suggesting that older mothers (notably those aged above 35 years) exhibited a reduced likelihood of having infants with growth failure. This observation is congruent with prior research positing that maternal maturity, enhanced caregiving experience, and superior access to resources may facilitate improved neonatal outcomes (17).

Nevertheless, an Iranian study focusing on very low birth weight infants identified younger maternal age as a potential risk factor, possibly attributable to economic volatility and a lack of health awareness among younger mothers (18). The disparity observed in our study may, in part, be elucidated by the maternal age distribution among the participants, where a majority (70.4%) were situated within the age bracket of 20 to 34 years, and merely 27.8% were aged beyond 35 years, indicating that maternal experience, rather than age in isolation, could exert a protective influence. This finding aligns with other studies indicating that younger mothers are more susceptible to delivering infants with compromised growth due to inadequate nutritional status, elevated psychological stress, and diminished access to antenatal healthcare (19, 20).

Remarkably, no statistically significant correlation was found in the current research study regarding the use of PGF with maternal socioeconomic status or education level. The discovery indicates that in the setting of the present research, the effect of demographic or prenatal risk factors could have been overridden by other stronger post-natal mechanisms of operation. That is, the quality and adequacy of the nutritional support and infection control practice of the neonatal hospitalization seem to have a significantly stronger effect than the maternal social background on the growth outcomes of neonatal hospitalization (21). This reading shifts the emphasis of prenatal

demographic management to the pressing need to improve in-hospital neonatal care policies, specifically, those related to nutrition and clinical surveillance in the NICU. In terms of neonatal attributes, the GA was found to be negatively associated with PGF, which aligns with the existing literature that shows that severely preterm babies have a lower metabolic reserve, underdeveloped gastrointestinal activity, and increased nutritional requirements that undergo insufficient development negatively affecting post-natal growth (22).

Premature infants born below 28 gestational weeks were especially susceptible, and this observation fits a U.S. multicentric study that found prevalence rates of 50 to 64 per cent of PGF in very preterm infants (1). Birth weight was also found to correlate negatively with PGF with a stronger correlation that played out the purpose of birth weight being one of the strongest predictors of growth outcomes. The study by Liao et al. (2019) in Taiwan has identified infants with extremely low birth weight (ELBW; <1000 g) to be at the much higher risk of post-discharge growth restriction (23). In the current analysis, 11.1% of the infants were ELBW and 57.4% were in the low birth weight (LBW; 1500-2500 g) category, which facilitates the explanation of the high overall prevalence of PGF. NEC showed a positive association with PGF, which was significant in the researches. NEC is a serious inflammatory disease of the intestine which directly leads to the impairment of the absorption of nutrients and in many cases the need to stop enteral nutrition, which leads to significant nutritional deficiencies and growth impairment (24).

Also, it was found that the utilize of TPN had a statistically significant positive relationship with PGF. There should be some caution in the interpretation of this relationship: even though TPN is often a life-saving procedure in infants with gastrointestinal dysfunction, it is not necessarily a causal agent of growth impairment. Rather, TPN should be regarded as a sign of the severity of underlying disease (25). Babies with prolonged TPN tend to manifest with serious comorbidities NEC, persistent sepsis, or significant feeding

intolerance (Hu et al., 2024). These conditions are accompanied by the systemic inflammatory response, which provokes a strong catabolic activity, thus raising metabolic requirements and shifting energy resources to survival at the cost of development (Clària, Arroyo, & Moreau, 2023). As a result, the existing correlation between TPN and PGF in the study is probably the reflection of the negative impact of significant clinical morbidities on the anabolic potential of neonates (Al-Saleh et al., 2023). Similar outcomes have been reported in other reports; a study by Kwinta et al. (2024) found out that there is a strong correlation between prolonged exposure to TPN and EUGR (Kwinta et al., 2024).

The complications and comorbidities had a significant impact on the postnatal developmental outcomes. It was found that RDS occurred in most infants, which can be explained by insufficient supplies of surfactants or the differences in respiratory treatment guidelines (van Kaam, Niemarkt, & Onland, 2023). The positive correlation between NEC and PGF is consistent with previous studies; significantly, a study by Yoon et al. (2023) has found NEC to be a significant risk factor of PGF in a Korean cohort (Yoon et al., 2023). Sepsis and patent ductus arteriosus (PDA) were also common and despite the fact that no direct relationship between sepsis and growth failure was found in the current data, the existing literature always helps to prove that infection and systemic inflammation interfere with growth processes and nutrient use (Rogulska et al., 2025). The prevalence of BPD in the present sample was less than those reported in high-income countries (Stoll et al., 2015), which might be explained by the differences in the number of diagnostic criteria or the discrepancy in the access to oxygen treatment in different clinical settings.

Caregiving and nutritional variables were also found all-important. PGF showed a negative relationship with the timestamp of the first enteral feeding, and this finding suggests that initiating feeding at a time within the first 24hours may have a protective influence in preventing post-natal growth retardation. The observation is in line with other reports that indicate the

prolonged feeding delays of over seven days are linked to high-risk of PGF (Chambers et al., 2023; Steventon et al., 2024). Enteral feeding in the current cohort was delayed (to after 24 hours) in most infants, probably due to an early clinical unstable condition. Also, the time to full enteral feeding (TTFE) exhibited a positive relationship with PGF, which highlights the importance of having an expedited initiation and progression of nutritional support.

Despite the fact that parenteral nutrition is necessary at the earliest stage of the neonatal period in cases of very preterm newborns, prolonged use of TPN in the absence of specific clinical evidence can inhibit the maturation of the gastrointestinal tract and disrupt growth processes (Skinner & Narchi, 2021).

Delays in the initiation of feeding and prolonged TTFE lead to a cumulative, energy and protein deficit, and this deficit will be increasingly difficult to correct as the later phases of hospitalization progress.

The modern clinical practices support the initiation of enteral nutrition within 24 hours of stable preterm infants and a faster acceleration in the volume of feeding to prevent the development of TTFE and prevent post-natal growth retardation (May et al., 2025). Taken together these findings highlight the central role of the importance of timely and strong enough nutritional management in the process of dampening the risk of PGF and improving the outcomes of babies. At both institutions, enteral feeding was typically withheld for 24–48 hours in infants < 32 weeks' gestation unless clinically stable.

Advancement followed a non-standardized approach based on individual physician discretion, with no established protocols on milk fortification, protein supplementation, or standardized rates of feeding progression.

A major undesired association between birth weight and the start of enteral feeding was revealed, meaning that infants having increased birth weight and those who received enteral feeding earlier were less prone to PGF (Getahun, Mulatu, & Workie, 2024). This observation aligns with international guidelines that support the introduction of enteral nutrition, however,

at the lowest volumes, to facilitate gastrointestinal activity and reduce intestinal inflammation (Thoene & Anderson-Berry, 2021).

PGF was significantly related to both the length of stay in the NICU and the post-discharge hospital readmission. The use of readmission, especially, acted as an indirect proxy of the post-discharge health of infants, and showed higher correlation with growth failure.

The most common reasons of readmission were sepsis, jaundice, and feeding issues, which all suggest that there is a possibility of the lack of follow-up and parental assistance after the discharge. Such outcomes provide the urgency to strengthen post-discharge surveillance systems and enhance parental neonatal care education. Growth failure exposes infants to higher risks of infection and their inability to maintain a good level of nutrition. Hospital readmissions also interfere with the compensatory growth pathway, thus intensifying the nutritional deficits and leading to the secondary systemic inflammation (Franceschi et al., 2021). Such observations suggest that inappropriate in-hospital growth has deleterious implications that will be passed on to post-discharge phase, thus undermining the long-term health stability of infants.

The main strength of this study is that it critically evaluates the variables of maternal, neonatal, and clinical care in a localized healthcare setting and as a result provides the context-specific evidence that can be used in the development of neonatal care policies and practices in Iraq.

This study had several limitations. The relatively small sample size may have reduced the statistical power of the study to detect weak associations. The lack of detailed data on the quality and quantity of breast milk, the type of formula consumed, and the exact duration of KMC were weaknesses of this study. Also, the study was cross-sectional and did not have long-term follow-up of the infants beyond two months of age, which could have provided valuable information on long-term developmental outcomes.

Conclusion

This study demonstrates that postnatal growth failure remains highly prevalent among preterm infants admitted to the participating NICUs, affecting 70.4% at 36 weeks' corrected gestational age. Several modifiable factors were significantly associated with PGF, including lower gestational age, low birth weight, delayed initiation of enteral feeding, prolonged time to achieve full enteral nutrition, necrotizing enterocolitis, extended reliance on total parenteral nutrition, and post discharge hospital readmission.

The universal absence of human milk fortification observed in this cohort highlights a critical gap in nutritional care, given the established recommendations for fortification to meet the heightened metabolic demands of preterm infants. Furthermore, the strong association between delayed feeding advancement and PGF underscores the importance of implementing standardized early feeding protocols to support adequate postnatal growth.

Collectively, these findings emphasize the need to strengthen in hospital feeding practices, particularly through timely initiation and fortification of enteral feeds and to ensure consistent post discharge growth monitoring to reduce the risk of postnatal growth failure in comparable neonatal care settings.

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