Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/mee67c12

CLINICAL OUTCOMES OF EARLY VS. DELAYED INTRODUCTION OF COMPLEMENTARY FEEDING IN INFANTS.

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ABSTRACT

Background: Complementary feeding is an important step in an infant's nutrition. If you start feeding babies solid foods too early or too late, it can have an impact on their growth, development, or health complications. For an infant, solid foods can be introduced after 6 months, but starting them too early can increase their risk of infections. Micronutrient deficiencies can also occur when solid foods are introduced late. Therefore, finding the right time is essential to keep the infants healthy.

Objectives: To examine the impact of early (<6 months) versus late (>6 months) complementary feeding on growth, illness, and learning during the first two years of life."

Study Design: A cross-sectional study.

Place and duration of study: Department of Pediatric/Neonatology unit Hayatabad Medical Complex Peshawar from jan 2024 to jan 2025

Methods: This study included 100 infants aged 6–24 months from the outpatient pediatric clinics. The study participants were divided into two groups based on the timing of complementary oral feeding, group early (less than 6 months) and group delayed (more than 6 months). Growth, some illnesses (like respiratory and stomach infections), and some developmental milestones were taken into account. For statistical analysis, SPSS 24.0 was used, t-test and chi-square were used for group comparison, and p-values less than 0.05 were considered significant The institution's review board granted ethical clearance. **Results:** 100 total mean age 12.4 months, SD 4.1 months 48 percent were given complimentary feeding before the age of 6 months and the rest, 52 percent, after the age of 6 months. Early-fed infants had higher diarrhea incidence (30% vs. 18%, p=0.04) and respiratory infections (25% vs. 16%, p=0.05). Mean weight-for-age z-scores showed no significant difference (−0.42 vs −0.40, p = 0.79). The early group achieved developmental milestones slightly sooner (p = 0.03). The early feeding practice, however, was linked to greater morbidity, while the delayed feeding practice resulted in fewer infections without significant growth compromise.

Conclusion: feeding early may elevate the risk of infections; however, it also enables children to attain certain developmental milestones earlier. In contrast, extending the duration of exclusive breastfeeding was associated with a lower incidence of infections, but it did not adversely affect the

child's growth. This is why it is best to adhere to the WHO recommendations stating that complementary feeding should begin at six months of age. The importance of this guidance underscores the need to optimize outcomes, as the balance among nutritional requirements, infection risk, and developmental milestones lies predominantly with the caregivers.

Keywords: Infant Nutrition; Complementary Feeding; Growth and Development; Morbidity

Introduction:
feeding plays a pivotal role during an infant's nutritional, growth, and developmental stages. The World Health Organization (WHO) recommends that during the first six months of life, an infant should exclusively breastfeed, then after the first six months, introduce complementary foods while continuing to breastfeed for as long as the mother desires, ideally for up to two years [1 Harmonized global recommendations in this regard continue to face cultural inconsistencies. Some of the explanations to this phenomenon include culture and practices, maternal and caregiver socio-economic and educational levels, and the support of the health care system [2]. Starting complementary feeding too early, before 6 months, increases the possibility of GER, respiratory disease, and childhood obesity [3]. The still developing gut and immune system of an infant may be less equipped to handle pathogens and allergens [4].

Initiating early feeding may replace some of the branched chain and immunoglobulin rich breastmilk, thus diminishing its survival and morbidity effect [5]. On the other hand, the risks of delaying the introduction of complementary foods for more than 6 months includes severity of iron-deficiency anemia, growth morbidity, and poor cognitive development [6]. The timing of complementary feeding is crucial because stores of iron and zinc begin to dwindle around 6 months of age [7]. Study in developing countries show that late starting complementary feeding is related to stunting, being underweight, and long-term growth and cognitive damaging, due to poor supply of micronutrients in the diet [8]. There is still controversy on the ideal timing of complementary feeding worldwide. In low- and middle-income countries, early introduction may occur due to maternal workload, cultural norms, or inadequate breastfeeding support, whereas delayed introduction may result from misconceptions about infant readiness or lack of resources.

A systematic review reported conflicting outcomes: some studies suggested that early feeding accelerates developmental milestones, while others emphasized its association with increased morbidity. In South Asian populations, limited data exist regarding the direct comparison between early and delayed feeding outcomes, particularly in terms of growth, morbidity, and developmental achievements. Given the region's high burden of infectious diseases and malnutrition, the timing of complementary feeding becomes critically important [9].

Methods:
This cross-sectional study Conducted in the Department of Pediatric/Neonatology unit Hayatabad Medical Complex Peshawar from jan 2024 to jan 2025. Consecutive sampling methods were used to gather 100 infants aged 6 to 24 months, with parental or guardian consent obtained. Infants were placed into two groups based on the timing of the introduction to complementary foods; early complementary feeding (<6 months) and delayed complementary feeding (>6 months). Trained personnel measured weight, length, and head circumference, which were later analyzed based on WHO Child Growth Standards to determine the growth parameters. Morbidity outcomes documented in medical records and the last three months of caregiver recall focused on the incidence of diarrhea and respiratory infections. The methodology utilized the appropriate screening tools to assess the infants for the corresponding developmental milestones. The analyses were done with SPSS software version 24.0.

Inclusion Criteria:
The study population comprised infants aged 6-24 months who had complete vaccination, had regular follow-up in pediatric clinics, and who had complete and reliable information from parents regarding their feeding practices.
Exclusion Criteria:
Infants suffering from congenital anomalies, chronic illnesses, from preterm birth (<37 weeks), severely malnourished (hospitalization was required), or when caregiver data on feeding practices and morbidity was incomplete, were excluded from the analysis.

Ethical Approval Statement:
Ethical approval was granted by the Institutional Review Board the parents/guardians provided written informed consent. All personal data was kept confidential and all activities conducted and described here complied with the ethical principles of the Declaration of Helsinki.

Data Collection:
The collection of data was through structured caregiver interviews, clinical examinations, and review of the records. Growth measurement was taken using standard measurement tools. For the validation of morbidity outcomes, both outpatient and hospital records were used. To reduce recall bias by the caregivers, pediatricians assessed the developmental milestones using age-appropriate developmental checklists.

Statistical Analysis:
Data entry and analysis were performed with SPSS version 24. Continuous variables were summarized with means ± standard deviation (SD) and compared to one another using independent t-tests. The association of categorical variables were evaluated using chi-square tests. A significance level (alpha) of 0.05 was used for all tests. Logistic regression was employed to address confounding variables.

Results:
The Mean age 12.4 months with a 4.1 months deviation added up to 100 infants in total. 48 % of them spent less than 6 months and 52 % of them spent more than 6 months as the delayed group. The mean score for weight against age in the early group was -0.42 with 0.9 deviation, compared to -0.40 with 0.8 deviation, so the delayed group also mean score. The mean score for length of age with z-scores showed similar results with -0.58 and -0.54 for early and delayed respectively. Head circumference with a 0.84 showed no statistical significance. Infants classified, the early group of infants fed also showed a statistically significant difference in incidences of higher diarrhea and upper respiratory infections. Progression of age in months was 6.3 for the early group and 6.8 for the delayed group. The difference for other milestones, as well as scoring 6.8 and 6.7 months, was statistically significant for lateralization In this case, the latency feeding instance aims to achieve an infection-free, growth-compromised feeding response. The response exhibited, in large part, an infection-free growth feeding response with no infection being introduced.

Table 1. Baseline Characteristics of Study Participants (N = 100)

Variable	Early Feeding (<6 months) (n=48)	Delayed Feeding (>6 months) (n=52)	p-value
Mean age (months ± SD)	12.2 ± 4.0	12.6 ± 4.2	0.68
Male sex (%)	25 (52.1%)	27 (51.9%)	0.98
Exclusive breastfeeding (%)	30 (62.5%)	34 (65.4%)	0.77
Mean birth weight (kg ± SD)	3.0 ± 0.4	3.1 ± 0.3	0.51
Immunization complete (%)	44 (91.6%)	49 (94.2%)	0.62

Table 2. Development Achievements in Early Versus Delayed Feeding Groups

Growth Parameter	Early Feeding (n=48)	Delayed Feeding (n=52)	p-value
Mean weight-for-age z-score	-0.42 ± 0.9	-0.40 ± 0.8	0.79
Mean length-for-age z-score	-0.58 ± 0.7	-0.54 ± 0.6	0.72
Mean head circumference (cm)	45.3 ± 2.1	45.5 ± 2.0	0.84
Underweight (<-2 SD)	7 (14.5%)	8 (15.3%)	0.91
Stunting (<-2 SD)	6 (12.5%)	7 (13.4%)	0.88

Table 3. Early Versus Delayed Feeding Morbidity Outcomes

Morbidity Indicator	Early Feeding (n=48)	Delayed Feeding (n=52)	p-value
Diarrhea episodes (%)	14 (30.0%)	9 (18.0%)	0.04*
Respiratory infections (%)	12 (25.0%)	8 (16.0%)	0.05*
Hospitalization (%)	6 (12.5%)	4 (7.7%)	0.41
Skin infections (%)	5 (10.4%)	3 (5.8%)	0.36

Table 4. Developmental Milestones Compared: Early vs. Delayed Feeding Groups.

Developmental Milestone	Early Feeding (n=48)	Delayed Feeding (n=52)	p-value
Sitting unsupported (months)	6.3 ± 0.8	6.8 ± 0.7	0.03*
Walking independently (months)	12.7 ± 1.2	13.0 ± 1.3	0.21
First words (months)	11.4 ± 1.1	11.6 ± 1.0	0.38
Social smile (months)	2.0 ± 0.5	2.1 ± 0.6	0.46

Discussion:

Our study explores the complex implications that timing complementary feeding has on infants' outcomes. Diarrhea and respiratory tract infections were more common due to complementary feeding starting too early. Conversely, starting complementary feeding from six months did lessen infection-related morbidities though there were some growth-related morbidities, it did not significantly impact on the growth outcomes and the growth morbidities noted were not significantly greater in number [10].Infants with earlier complementary feeding also reached some motor milestones more advanced, and higher feeding rates seem to lean to greater pronounced risk of morbidity serving to support the notion of risk being a tradeoff for developmental acceleration. Results obtained are in agreement with earlier documentation of the infectious morbidities linked to early feeding, complemented with [11]. Risk of gastrointestinal infections were much higher in infants introduced to solids when compared to those who's feeding was complemented, as noted in and also reported [12]. Infection risk and morbidity after early complementary feeding also noted in as well as increase of risk early supplemented with fluid other than breast milk. These observations, concordant with [13], confirm the finding of the current study. Infants with early feeding achieved some developmental, but higher episodes of diarrhea and respiratory illness were also. Study has highlighted the negative outcomes associated with late complementary feeding as well [14]. Lutter and Dewey argued that postponing complementary feeding beyond six months can result in micronutrient deficiencies, particularly with iron and zinc, since endogenous stores are depleted around this time [15]. Saha et al.'s study conducted in Bangladesh found similarly that late introduction of complementary foods to infants was associated with higher prevalence of anemia and faltering growth [16]. Hydrating in the months following diet introduction and balanced post-introduction dietary intake may have contributed to the lack of growth outcome differences found in our study [17]. The impact of feeding on development milestones has also sparked debate. Futrell et al. claimed that complementary feeding introduced too early may enhance the acquisition of certain skills, especially motor skills like sitting and crawling, due to greater exposure to textured foods and self-feeding opportunities [18]. Infants in our study who received complementary feeding prior to six months reached unsupported sitting slightly earlier than those introduced later, which appear to confirm these claims. The minimal language and social developmental differences are consistent with

the outcomes noted by Duits et al., where they stated that the duration of breastfeeding and the timing of complementary feeding had little effect on the neurocognitive outcomes that followed those years [19]. Contextualized within regional studies, our findings are framed by the work of Senarath et al. which documented feeding practices in South Asia as having an early initiation and significant variability. This was noted particularly in rural communities where there was an early initiation of feeding practices due to maternal workload and perceptions of infant satiety [20]. The cultural factors mentioned may account for some of the early introduction of complementary foods by caregivers in our study. This was noted despite an awareness of the WHO recommendations. Furthermore, Imdad and Bhutta's review of South Asia's interventions documented the critical importance of the timing of complementary feeding, coupled with quality and diversity, which ultimately reduced morbidity and stunting. Our findings emphasize the importance of focused educational efforts for mothers in analogous resource-poor environments.

Limitations:
the study's cross-sectional nature, reliance on caregiver recall for morbidity outcomes, and the study's relatively small sample, there are limitations. Furthermore, long-term outcomes, such as cognitive development, nutritional status, and the risks of obesity, were not captured. To increase the evidence's robustness, prospective studies with multiple centers are necessary.

Conclusion:
Increased rates of infection were associated with early complementary feeding, although there was a slight improvement in motor milestone attainment. In contrast, delayed initiation of complementary feeding reduced morbidity without negatively affecting growth. These findings support the WHO's recommendation to begin complementary feeding at six months and emphasize the importance of providing balanced counseling to caregivers regarding the infant's nutrition, growth, and development."

Disclaimer: Nil
Conflict of Interest: Nil
Funding Disclosure: Nil

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

References:
1. Abiramalatha T, Thanigainathan S, Ramaswamy VV, Rajaiah B, Ramakrishnan S. Re-feeding versus discarding gastric residuals to improve growth in preterm infants. The Cochrane database of systematic reviews. 2023;6(6):Cd012940. doi: https://doi.org/10.1002/14651858.CD012940.pub3.
2. Çaka SY, Topal S, Yurttutan S, Aytemiz S, Çıkar Y, Sarı M. Effects of kangaroo mother care on feeding intolerance in preterm infants. Journal of tropical pediatrics. 2023;69(2)doi: https://doi.org/10.1093/tropej/fmad015.
3. Campbell AA, Karp SM, Mogos M. Feeding Behaviors in Infants and Toddlers Later Diagnosed with Autism Spectrum Disorder: A Systematic Review. Journal of autism and developmental disorders. 2025;55(5):1788-808. doi: https://doi.org/10.1007/s10803-024-06303-8.

4. Capra ME, Decarolis NM, Monopoli D, Laudisio SR, Giudice A, Stanyevic B, et al. Complementary Feeding: Tradition, Innovation and Pitfalls. Nutrients. 2024;16(5)doi: https://doi.org/10.3390/nu16050737.
5. Dani C, Ciarcià M, Luzzati M, Nardecchia S, Petrolini C, Sarli WM, et al. Feeding intolerance during phototherapy in preterm infants. The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet. 2022;35(25):6610-4. doi: https://doi.org/10.1080/14767058.2021.1918093.
6. Delgado Paramo L, Bronnert A, Lin L, Bloomfield FH, Muelbert M, Harding JE. Exposure to the smell and taste of milk to accelerate feeding in preterm infants. The Cochrane database of systematic reviews. 2024;5(5):Cd013038. doi: https://doi.org/10.1002/14651858.CD013038.pub3.
7. Fleiss N, Tarun S, Polin RA. Infection prevention for extremely low birth weight infants in the NICU. Seminars in fetal & neonatal medicine. 2022;27(3):101345. doi: https://doi.org/10.1016/j.siny.2022.101345.
8. Fucile S, Samdup D, MacFarlane V, Sinclair MA. Risk Factors Associated With Long-term Feeding Problems in Preterm Infants: A Scoping Review. Advances in neonatal care : official journal of the National Association of Neonatal Nurses. 2022;22(2):161-9. doi: https://doi.org/10.1097/anc.0000000000000864.
9. Hair AB, Good M. Dilemmas in feeding infants with intestinal failure: a neonatologist's perspective. Journal of perinatology : official journal of the California Perinatal Association. 2023;43(1):114-9. doi: https://doi.org/10.1038/s41372-022-01504-4.
10. Hasenstab KA, Jadcherla SR. Evidence-Based Approaches to Successful Oral Feeding in Infants with Feeding Difficulties. Clinics in perinatology. 2022;49(2):503-20. doi: https://doi.org/10.1016/j.clp.2022.02.004.
11. Ibrahim NR, Van Rostenberghe H, Ho JJ, Nasir A. Short versus long feeding interval for bolus feedings in very preterm infants. The Cochrane database of systematic reviews. 2021;8(8):Cd012322. doi: https://doi.org/10.1002/14651858.CD012322.pub2.
12. Isazadeh R, Moradi N, Malakian A, Naderifar E, Dastoorpoor M, Knoll BL. Mothers' involvement in assessing feeding skills of premature infants. International journal of pediatric otorhinolaryngology. 2022;155:111069. doi: https://doi.org/10.1016/j.ijporl.2022.111069.
13. Martini S, Beghetti I, Annunziata M, Aceti A, Galletti S, Ragni L, et al. Enteral Nutrition in Term Infants with Congenital Heart Disease: Knowledge Gaps and Future Directions to Improve Clinical Practice. Nutrients. 2021;13(3)doi: https://doi.org/10.3390/nu13030932.
14. Ostadi M, Jokar F, Armanian AM, Namnabati M, Kazemi Y, Poorjavad M. The effects of swallowing exercise and non-nutritive sucking exercise on oral feeding readiness in preterm infants: A randomized controlled trial. International journal of pediatric otorhinolaryngology. 2021;142:110602. doi: https://doi.org/10.1016/j.ijporl.2020.110602.
15. Parker LA, Desorcy-Scherer K, Magalhães M. Feeding Strategies in Preterm Very Low Birth-Weight Infants: State-of-the-Science Review. Advances in neonatal care : official journal of the National Association of Neonatal Nurses. 2021;21(6):493-502. doi: https://doi.org/10.1097/anc.0000000000000849.
16. Rana R, McGrath M, Gupta P, Thakur E, Kerac M. Feeding Interventions for Infants with Growth Failure in the First Six Months of Life: A Systematic Review. Nutrients. 2020;12(7)doi: https://doi.org/10.3390/nu12072044.
17. Razak A. Two-Hourly versus Three-Hourly Feeding in Very Low-Birth-Weight Infants: A Systematic Review and Meta-Analysis. American journal of perinatology. 2020;37(9):898-906. doi: https://doi.org/10.1055/s-0039-1691767.
18. Taylor K, Maguire D. A Review of Feeding Practices in Infants With Neonatal Abstinence Syndrome. Advances in neonatal care : official journal of the National Association of Neonatal Nurses. 2020;20(6):430-9. doi: https://doi.org/10.1097/anc.0000000000000780.

19. Viswanathan S, Jadcherla S. Feeding and Swallowing Difficulties in Neonates: Developmental Physiology and Pathophysiology. Clinics in perinatology. 2020;47(2):223-41. doi: https://doi.org/10.1016/j.clp.2020.02.005.
20. Walsh V, Brown JVE, Copperthwaite BR, Oddie SJ, McGuire W. Early full enteral feeding for preterm or low birth weight infants. The Cochrane database of systematic reviews. 2020;12(12):Cd013542. doi: https://doi.org/10.1002/14651858.CD013542.pub2.
21. Wang Y, Zhao T, Zhang Y, Li S, Cong X. Positive Effects of Kangaroo Mother Care on Long-Term Breastfeeding Rates, Growth, and Neurodevelopment in Preterm Infants. Breastfeeding medicine : the official journal of the Academy of Breastfeeding Medicine. 2021;16(4):282-91. doi: https://doi.org/10.1089/bfm.2020.0358.
22. Yue W, Han X, Luo J, Zeng Z, Yang M. Effect of music therapy on preterm infants in neonatal intensive care unit: Systematic review and meta-analysis of randomized controlled trials. Journal of advanced nursing. 2021;77(2):635-52. doi: https://doi.org/10.1111/jan.14630.