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Review article

Optimizing premature nutrition: An updated review of human and donor milk fortification and its implication in growth and neurodevelopmental outcomes

Mahaveer Singh Lakra[a], Ashwini Lakra[b], Ishani Arora[b], Heena Bhandekar[b], Amar Taksande[a], Mayur Wanjari[a], Roshan Prasad[a, *]

[a]*Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India*
[b]*Datta Meghe Medical College, Datta Meghe Institute of Higher Education and Research, Nagpur, Maharashtra, India*

Abstract

Poor intra- and extrauterine growth, as well as inadequate protein supplementation during the first weeks in premature babies, are linked to long-term growth failure and impaired brain development. The calorie requirements of premature newborns cannot every time be fulfilled, even with routine and traditional fortification. This is because conventional fortification relies on the presumed well-known composition of human milk rather than the measured and calculated composition thereof. The protein content of milk in mother's of preterm babies, varies with breastfeeding duration and the content of donor human milk varies when it is pasteurised and preserved in human milk banks for prolonged duration. Newer fortification techniques, such as individualized, targeted approaches, are required to address these challenges of protein and micronutrient undernutrition, which have led to the concept of "lacto-engineering." This review article focuses on recent feeding practice updates, including traditional and targeted fortification, bedside human milk content analysis, lacto-engineering, and their implications in neonatal intensive care units, particularly in developing countries.

Keywords: Human milk analysis, lactoengineering, neurodevelopment, preterm, targeted fortification.

Poor intra- and extrauterine growth is generally associated with a decrease in brain volume, altered brain structure, decreased number of neuronal cells, and defective migration and myelination processes with poor arborization. (1) Various studies have shown (2) that undernutrition throughout the newborn and infant period can seriously affect the developing brain and lead to neuro-morbidity later in life. Proper nutrition plays an integral role in the outcome and care of preterm and low birth weight (LBW) babies and enhances their growth and development. Fortunately, poor growth can be avoided or reduced by improving nutrition practices and balancing nutrient supplementation. Moreover, nutritional build-up also decreases infection rates, hospital stays, sepsis rates, and incidences of necrotizing enterocolitis (NEC). It also facilitates good weight gain, adequate linear growth, and favorable neurological outcomes in later life. Growth retardation is common in very preterm and LBW babies and is linked to poor neurodevelopmental outcomes. (3, 4) Optimized protein and energy provided to preterm babies during their initial weeks after birth were found to be directly associated with good long-term neurodevelopmental outcomes. (5) Therefore, optimizing adequate feeding and nutrition in the early phase of life should be a priority in the care provided during the postnatal period. Despite the best neonatal care, premature LBW babies are at high risk of infections, malnutrition, poor skeletal growth, and impaired cognition, and it is challenging to overcome this nutritional deficit during this unstable phase. Human milk protein and nutritional content vary depending on the number of days postnatal and the type of milk. This was recently demonstrated by comparing the expected and actual

***Correspondence to: Roshan Prasad,** Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, India.
E-mail: Roshanprasad2000@gmail.com
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protein consumption in preterm newborns fed fortified human milk. Because the composition of term milk differs significantly from preterm milk, it must be modified before being given to preterm newborns to meet their nutritional requirements.

When a preterm baby begins to feed in a clinically stable manner, it is critical to adequately address the accumulated nutritional deficit to augment postnatal growth and development to match the recommended standard. The goal should be adequate chronological development to avoid the adverse effects of stunted postnatal growth. Therefore, we reviewed recent infant feeding strategies, human milk fortification, and the long-term consequences of inadequate feeding and introduced the concept of individual milk analysis lacto-engineering.

The objective of this review article is to critically evaluate the currently employed strategies for fortifying human and donor milk, with a focus on their impact on the growth and neurodevelopmental outcomes in preterm infants. By correlating recent evidence and clinical guidelines, we aimed to provide insights into the optimal nutritional approaches to enhance the health and development of this vulnerable population.

Mother's milk and its nutritional value

Mother's milk is the best nutritional source for babies, as it decreases mortality and morbidity and significantly improves neurological outcomes. It protects against sepsis and various other infections. [6 - 8] Human milk also protects against NEC in preterm babies, who are prone to developing this because of their immature gut. [9, 10] A higher incidence of NEC, sepsis, compromised renal functions, and feed intolerance is seen in babies fed on formula milk instead of their mother's milk. [11]

In very premature and LBW babies, exclusive and early breastfeeding results in fewer chances of developing NEC in comparison to babies fed on animal milk because of the risk of protein allergy and poor immunological content. [12] All babies in the neonatal intensive care unit (NICU) should be offered to be breastfed, or the mother's breast milk should be expressed if preterm and there is any issue with sucking and coordination. Sometimes, direct breastfeeding is not possible because of severe immaturity and poor coordination in sick, intubated babies and babies who are not hemodynamically stable. In conditions where the mother has lactation failure or the mother's milk is contraindicated for some reason, pasteurized donor human milk can be used. The requirement for protein and calories is greater in preterm babies to balance ongoing catabolism. Unsurprisingly, various studies found that most preterm babies experience growth failure.

Chinnapan A, *et al.* [13] studied the supplementation of human milk in 123 preterm babies and compared it with routine human milk fortification and preterm formula milk fortification. They found that the weight gain was equal in both groups. However, preterm formula milk had a lower incidence of feed intolerance than human milk fortifier (HMF), with a ratio of 1.4 *vs*. 6.8 in the two groups, respectively. This study did not reveal an increase in the risk of stage 2 NEC and extrauterine growth. They observed that preterm formula milk was not inferior compared to HMF when used to fortify human milk for preterm neonates.

In a randomized study on the growth of preterm babies with human milk fortified with an infant formula powder *vs*. unfortified human milk, Gupta V, *et al.* [14] discovered that weight gain (1.98 gm/kg/day; 95% confidence interval (CI), 1.0 - 2.9 gm/kg/day) and the linear growth (0.1 cm/week; 95% CI, 0.02 - 0.2 cm/week) were significantly higher in the fortified milk groups than in the control groups. They also found increased head circumference and a shorter total hospital stay of babies in the fortification group, but no difference in the incidences of NEC, feed intolerance, and biochemical parameters.

Mukhopadhyay K, *et al.* [15] performed a randomized control study on 166 preterm newborns to assess the impact of human milk fortification on a baby's growth and metabolic markers. They randomly enrolled 85 and 81 babies into two groups (fortified *vs*. non-fortified groups). They observed that preterm infants with very low birth weight (VLBW) in the fortification group gained considerably more weight (15.1 *vs*. 12.9 g/kg/day), had a larger head circumference (0.8 *vs*. 0.8 cm/week), and a longer length (1.0 *vs*. 0.9 cm/week). A sub-analysis revealed that in babies small for their gestational age who have received fortification, there was a greater increase in length and weight than in the non-fortified group. The fortified group showed significant improvements in length and weight compared with the control group, whereas in babies with appropriate weight for their gestational age, the fortified group showed significant improvements in length. However, no difference in weight gain and head circumference was found between the two groups. All biochemical parameters were comparable in the two groups, but it was shown that feeding intolerance was more evident in the fortification group. Therefore, human milk fortification provides a better increase in the growth rate in VLBW preterm babies. The composition of any ideal milk formula should be close to that of human milk to avoid an unnecessary solute load on the kidneys. The ideal milk formula should supply all nutrients as per the baby's requirements, as shown in **Table 1.**

Suppose adequate calories and protein are not supplemented during feeding, especially during the early postnatal weeks. In that case, the baby's appropriate growth, weight gain, and brain growth are compromised, which can affect their neurodevelopment outcomes and intelligence in later life. Comparing fetal growth charts, it was revealed that the growth of premature infants is much more suboptimal than that of the fetus *in utero*. Many of these babies may not attain optimal growth until the time of discharge. Growth curves should be used for each baby to identify any illness or feeding issues and for adequate follow-up. They must be implemented in NICUs. [16] Therefore, the standard for premature babies' nutrition is to reach fetal accretion and growth as *in utero*.

Aim of human milk fortification

Low protein intake during the initial weeks of preterm babies is related to long-term growth failure and poor neurodevelopmental outcomes. A preterm baby's protein nutrient requirements are higher than those of a term baby. Human milk alone in preterm babies does not provide all the necessary calories, micronutrients, and proteins required for optimized growth and can result in poor growth, anemia, and hypophosphatemia. [17] Because of the high requirements, this comparatively deficient state may cause short- and long-term growth impairment along with the compromised cognitive development of preterm babies. [4, 5] Various studies have shown that human milk alone without fortification did not meet the high demand for adequate nutrition and growth in premature babies. Preterm feeds must be made calorie- or protein-dense with HMFs or preterm formulas. In the last 1 - 2 decades, traditional HMFs have gained much attention and are routinely used in NICUs. Fortification of human milk with minerals, vitamins, and trace elements does not cause many problems, as slight shortfalls or excesses of these nutrients do not cause detrimental effects in babies. Meanwhile, the fortification of milk with protein is challenging. As mentioned, protein is an essential component of brain and body tissue growth, and any shortfall of all essential nutrients and proteins is detrimental to their neurodevelopmental growth. In addition, excess protein intake is also harmful, causing hypertonicity and renal derangements. The recommended daily allowance and comparative effect of fortification on protein, calories, and nutrients for preterm LBW babies [18] are presented in **Table 2.**

Nutritional assessment in babies

The nutritional assessment for each baby should be individualized. The primary method is regularly and meticulously performed anthropometry, and standard growth charts are maintained for assessment and comparison. The nutritional status of newborns must be appropriately evaluated after birth with proper anthropometry and precisely documented. This process should be conducted regularly during the hospital stay and follow-up. Evaluating neonatal nutritional status using anthropometric and physical indices is a relatively simple, affordable, and effective tool that does not require sophisticated medical or surgical devices. Intrauterine and postnatal growth charts are primarily based on the gestational age, and

Table 1. Ideal composition of milk formulas required in babies.

Content	Amount in gram /100 ml of formula
Protein	2 g and whey protein to casein ratio should be 60:40
Fat	Butter fat, DHA, and polyunsaturated FA, 4 g, 2 g, 2 g respectively
Carbohydrate	Lactose and maldextrin10 - 12, 5 - 6 each ideally 40.0% - 50.0% lactose and 50.0% - 60.0% maldextrose and polycose
Osmolarity	300 milliosmole/L
Renal solute load	Around 100 milliosmole/L
Calories, vitamins, and mineral supplements	80 Kcal, As the RDA demand of the baby

DHA, docosahexaenoic acid; FA, fatty acid; RDA, recommended daily allowance.

Table 2. Recommended daily allowance and comparative effect of fortification on protein, calories and nutrients for preterm low birth weight babies.

Parameter	Recommended daily allowance (RDA)	Expressed mature milk only	Expressed milk fortified with Lactodex new HMF 4g/100ml	Expressed milk fortified with Pre nan HMF 5g/100ml	Expressed milk fortified with preterm formula	Lactodex LBW formula
Energy (Kcal)	135	117	141	144	153	160
Protein (g)	3 - 4	2.5	4.4	4.1	3.5	4.0
Carbohydrate (g)	11.6 - 13.2	11.6	15.1	17.7	15.4	17.8
Fat (g)	4.8 - 6.6	6.8	7.1	6.8	8.6	8.0
Calcium (mg)	121 - 140	157	157	151	90	256
Phosphate (mg)	60 - 90	79	79	87	45	128
Vitamin D (IU)	1,330 - 3,330	680	2,120	2,383	1,224	481
Folic acid (mcg)	35 - 100	6	96	64	22.2	96
Vitamin E (IU)	2.2 - 11.0	1.8	7.8	7.6	2.9	6.4
Zinc (mg)	1.1 - 2.0	0.6	0.9	1.9	0.9	1.6
Iron (mg)	2.0 – 3.0	0.2	2.4	2.8	1.0	3.8
Vitamin B6 (IU)	45 - 300	25.7	-	205	72.5	81
Deficient in	-	Protein, Calcium, Vitamin B6 and D	Zinc is less	Vitamin D	Calcium, Phosphate, and most of the vitamins	Vitamin A and D

IU, international unit; MCG, micrograms; MG, miligrams.

a postnatal growth chart per gestational age is preferred as it represents the realistic postnatal growth among various newborns. The two standard growth charts used for preterm VLBW neonates are the Wright and Fenton. World Health Organization growth charts can be used once the preterm baby reaches 40 weeks postmenstrual age. [19, 20]

Adhering to specific feeding practices in the NICU is vital for promoting early recovery and optimal weight gain in newborns. Priority is given to exclusive breastfeeding, with expressed breast milk being used if direct feeding is not feasible and donor human milk as an alternative. The early initiation of breastfeeding is encouraged unless contraindicated. Nutrient intake must meet the recommended guidelines, and infants at risk of feed intolerance should receive early trophic feeding, fortified feeds, and supplements, as necessary. Regular anthropometric measurements, including weight, head circumference, length, and ponderal index, aid in growth monitoring. Growth parameters should align with the recommended intrauterine growth curves, with daily weight measurements until the appropriate birth weight is reached and consistent weight gain is achieved for three consecutive days. Monitoring of activity, abdominal circumference, and aspirate characteristics during feeding is also essential, with weekly weight and head circumference measurements during follow-up. Optimal weight gain targets are set at 15 - 20 g/d, while head circumference and length should increase by 0.7 - 1.0 cm/week. These comprehensive feeding practices in the NICU are crucial for the early recovery and healthy development of newborns. [20]

Limitations of conventional fortification

Despite the fortification of human milk, preterm babies are still affected by poor growth and impaired development because of low protein intake during feeding in the NICU. Traditionally, human milk is fortified as per the assumption that it lacks some of the standard nutrients. However, preterm human milk has a varied protein content that diminishes as breastfeeding progresses. The precise protein content in the mother's milk is unknown unless the exact amount is measured by laboratory analysis. Furthermore, human milk preserved in the milk bank has a lower protein content as it is stored for a long time. Moreover, when comparing the expected and absolute protein intakes in preterm infants fed fortified human milk, the actual protein intake was lower when fortification was performed using the traditional method. The European Human Milk Association recommends the targeted, individualized, and adjustable fortification approach, as the standard fortification cannot meet the fortification requirements of very premature babies. [21] In addition, conventional fortification was used to be blind, which sometimes led to hyperosmolarity, protein overload, decreased gastric emptying time, hypercalcemia, and NEC. [22]

This blind use can cause protein overload on the kidneys and increased milk osmolarity, as well as increase the risk of developing NEC. [23] This has given rise to the concept of individualized and targeted human milk fortification based on the measured deficient nutrients in milk. Many techniques have been explored to produce formulas that are physiologically equal to breast milk, but they have been unable to entirely replicate all the characteristics thereof. Lactoferrin, immunoglobulin, lipase, peptide, and other growth factors that are present solely in the mother's milk are missing from commercially available formulas. These formulations cannot substitute the natural components contained in human milk. Whatever advanced method or technology we employ, we will likely never be able to fully reproduce something precisely like human milk in every way. Furthermore, the humanization of milk formulas will undoubtedly necessitate high costs and innovative technologies.

Lacto-engineering

The advanced strategies of human and donor milk fortification and their effect on the long-term growth and neurodevelopmental outcomes of premature babies are relatively new concepts and are being practiced in tertiary care hospitals. The approach should be individualized to optimize fortification. This individually based fortification can be targeted or adjustable. Adjustable fortification is more practical and avoids excessive protein intake. Arslanoglu S, *et al*. [24] found that the fortification process can be further improved by adding the specific nutrient that was identified to be deficient to the milk. If we can identify the proper concentration of nutrients in human milk, we can fortify milk with only the specific nutrients. A milk analyzer can analyze the exact concentration of nutrients in human milk. [25, 26] This can be used during each baby feeding, and the deficient nutrients can then be fortified, which would reduce extrauterine growth failure in preterm babies and improve their developmental outcomes. When standardized milk is given to a baby, it can be established which nutrients are deficient and must therefore be added. We can calculate the nutrients in the available fortifiers according to the needs and requirements of the baby so that the unnecessary solute load due to extra protein and carbohydrates can be avoided. [27, 28] The advantages of optimizing human milk fortification and lacto-engineering would be that we lower the solute and protein loads, thereby reducing the cost and burden of commercially available HMF sachets.

Here, we address a newer concept of human milk fortification for preterm babies, which is currently known as "lacto-engineering." The European Milk Bank Association recommends that preterm baby feeding be fortified and that the routine, recommended, adjustable, and targeted fortification methods should be adopted and individualized as per the baby's needs. However, it does not recommend post-discharge fortification and hydrolyzed protein formulas. The adjustable and targeted methods of fortification are the most feasible and practical, and in resource-constrained situations, fortification is determined by the setting, availability, economic status, and affordability. However, standard fortification might not meet the baby's individual needs and may compromise their ultimate growth and development in later life. [29] Thus, a preterm formula or standard HMF should be used for fortification. The latest strategy is lacto-engineering, where the milk contents are analyzed and the deficient nutrients are substituted in the milk for preterm babies. Suppose we analyze the content of human milk from a mother or pasteurized donor and titer its fortification as per the baby's requirement. In this case, an unnecessary load of extra protein and carbohydrates on the body tissues can be avoided. In extremely premature babies where early milk supplementation is done starting from birth, it does not increase fat accretion but improves the linear growth velocity, early weight gain, and head circumference. [30]

Implications

This intervention can reduce the duration of stay in the NICU and improve their overall outcome. From various new and old research, it is obvious that protein is essential to reduce postnatal growth failure in preterm babies. Furthermore, using complete human milk-based fortifiers rather than bovine components is a challenging but better alternative. This will help babies attain linear growth, appropriate neurodevelopment, and good long-term neurocognitive function. [3 - 5] Moreover, this may attenuate the untoward effects of hyperosmolarity, renal overload, electrolyte imbalance, and protein overload in newborns. [11, 22]

Implementing these strategies will decrease unnecessary use of and reduce the cost of HMF sachets in the NICU. The total burden of treatment cost on parants can be lowered, especially in low-income countries. Fortification of human milk is a vital step in NICU care. Therefore, a new "adjustable fortification" approach must be emphasized to provide a more practical approach for appropriate growth. Lacto-engineering is a new and challenging approach based on individual analysis and human milk fortification. [29, 30] However, human milk fortification is more complex than the previous standard fortification, which was based merely on assumptions of human milk content and led to suboptimal supplementation. These newly targeted fortification and lacto-engineering strategies will improve the linear growth and cognitive development of babies in the NICU. This can lower the neonatal mortality rate and improve neurodevelopmental outcomes.

Conclusion

Human milk alone is deficient in proteins and other micronutrients and appears to be inadequate for a baby's overall growth and brain development. The bedside milk analysis and targeted fortification of milk, along with newer methods of fortification will facilitate balanced growth and brain development and can be more cost effective. By implementing this, malnutrition among children can be reduced in developing countries, and changing the fortification practice paradigm may increase the survival rate of preterm babies.

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This review is based on the references cited. All data generated or analyzed in this study are included in this published article and the citations herein. Further details, opinions, and interpretation are available from the corresponding author on reasonable request.

References

1. Miller SL, Huppi PS, Mallard C. The consequences of fetal growth restriction on brain structure and neurodevelopmental outcome. J Physiol 2016;594: 807-23.
2. Prado EL, Dewey KG. Nutrition and brain development in early life. Nutr Rev 2014;72:267-84.
3. Ehrenkranz RA, Dusick AM, Vohr BR, Wright LL, Wrage LA, Poole WK. Growth in the neonatal intensive care unit influences neurodevelopmental and growth outcomes of extremely low birth weight infants. Pediatrics 2006;117:1253-61.
4. Chan SHT, Johnson MJ, Leaf AA, Vollmer B. Nutrition and neurodevelopmental outcomes in preterm infants: a systematic review. Acta Paediatr 2016;105:587-99.
5. Stephens BE, Walden RV, Gargus RA, Tucker R, McKinley L, Mance M, et al. First week protein and energy intakes are associated with 18-month developmental outcomes in extremely low birth weight infants. Pediatrics 2009;123:1337-43.
6. Roggero P, Liotto N, Amato O, Mosca F. The potential effects of human milk on morbidity in very-low-birth-weight preterm infants. Nutrients 2020;12:1882.
7. Blaymore Bier JA, Oliver T, Ferguson A, Vohr BR. Human milk reduces outpatient upper respiratory symptoms in premature infants during their first year of life. J Perinatol 2002;22:354-9.
8. Wu Y, Zhong XY, Jiang J, Gong H. Prospective and controlled study on effect of fortified human milk feeding on infants with extremely and very low birth weight during hospital stay. Beijing Da Xue Xue Bao Yi Xue Ban 2016;48:143-8.
9. Henderson G, Craig S, Brocklehurst P, McGuire W. Enteral feeding regimens and necrotising enterocolitis in preterm infants: a multicentre case-control study. Arch Dis Child Fetal Neonatal Ed 2009;94:120-3.
10. Sisk PM, Lovelady CA, Dillard RG, Gruber KJ, O'Shea TM. Early human milk feeding is associated with a lower risk of necrotizing enterocolitis in very low birth weight infants. J Perinatol 2007;27:428-33.
11. Bacchetta J, Harambat J, Dubourg L, Guy B, Liutkus A, Canterino I, et al. Both extrauterine and intrauterine growth restriction impair renal function in children born very preterm. Kidney Int 2009;76:445-52.
12. Sullivan S, Schanler RJ, Kim JH, Patel AL, Trawöger R, Kiechl-Kohlendorfer U, et al. An exclusively human

milk-based diet is associated with a lower rate of necrotizing enterocolitis than a diet of human milk and bovine milk-based products. J Pediatr 2010;156: 562-7.e1.

13. Chinnappan A, Sharma A, Agarwal R, Thukral A, Deorari A, Sankar MJ. Fortification of breast milk with preterm formula powder *vs* human milk fortifier in preterm neonates: a randomized noninferiority trial. JAMA Pediatr 2021;175:790-6.
14. Gupta V, Rebekah G, Sudhakar Y, Santhanam S, Kumar M, Thomas N. A randomized controlled trial comparing the effect of fortification of human milk with an infant formula powder versus unfortified human milk on the growth of preterm very low birth weight infants. J Matern Fetal Neonatal Med 2020;33:2507-15.
15. Mukhopadhyay K, Narnag A, Mahajan R: Effect of human milk fortification in appropriate for gestation and small for gestation preterm babies: a randomized controlled trial. Indian Pediatr 2007;44:286-90.
16. Ehrenkranz RA, Younes N, Lemons JA, Fanaroff AA, Donovan EF, Wright LL, et al. Longitudinal growth of hospitalized very low birth weight infants. Pediatrics 1999;104 (2 Pt 1):280-9.
17. Lugonja N, Marinkovic V, Pucarevic M, Miletic S, Stojic N, Crnkovic D, et al. Human Milk-The Biofluid That Nourishes Infants from the first day of life. Foods 2024;13:1298.
18. Sankar MJ, Agarwal R, Mishra S, Deorari AK, Paul VK. Feeding of low birth weight infants. Indian J Pediatr 2008;75:459-69.
19. Bertino E, Di Nicola P, Varalda A, Occhi L, Giuliani F, Coscia A. Neonatal growth charts. J Matern Fetal Neonatal Med 2012;25 (Suppl 1):67-9.
20. Seliga-Siwecka J, Fia³kowska J, Chmielewska A. Effect of targeted vs. Standard fortification of breast milk on growth and development of preterm infants (≤ 32 Weeks): Results from an interrupted randomized controlled trial. Nutrients 2023;15:619.
21. Arslanoglu S, Boquien CY, King C, Lamireau D, Tonetto P, Barnett D, et al. Fortification of human milk for preterm infants: Update and recommendations of the European milk bank association (EMBA) working group on human milk fortification. Front Pediatr 2019;7:76.
22. Arslanoglu S, Moro GE, Ziegler EE. Adjustable fortification of human milk fed to preterm infants: does it make a difference?. J Perinatol 2006;26:614-21.
23. Kreins N, Buffin R, Michel-Molnar D, Chambon V, Pradat P, Picaud JC. Individualized fortification influences the osmolality of human milk. Front Pediatr 2018;6:322.
24. Arslanoglu S, Bertino E, Coscia A, Tonetto P, Giuliani F, Moro GE. Update of adjustable fortification regimen for preterm infants: a new protocol. J Biol Regul Homeost Agents 2012;26 (3 Suppl):65-7.
25. Fusch G, Kwan C, Kotrri G, Fusch C. “Bed side” human milk analysis in the neonatal intensive care unit: a systematic review. Clin Perinatol 2017;44:209-67.
26. Leghi GE, Middleton PF, Netting MJ, Wlodek ME, Geddes DT, Muhlhausler BS. A systematic review of collection and analysis of human milk for macronutrient composition. J Nutr 2020;150:1652-70.
27. McLeod G, Sherriff J, Hartmann PE, Nathan E, Geddes D, Simmer K. Comparing different methods of human breast milk fortification using measured v. assumed macronutrient composition to target reference growth: a randomised controlled trial. Br J Nutr 2016;115:431-9.
28. Talebiyan S, Belfort MB. Human milk fortification for very preterm infants: Toward optimal nutrient delivery, neonatal intensive care unit growth, and long-term outcomes. Clin Perinatol 2023;50:625-41.
29. Thanigainathan S, Abiramalatha T. Early fortification of human milk versus late fortification to promote growth in preterm infants. Cochrane Database Syst Rev 2020 ;7:CD013392.
30. Salas AA, Gunawan E, Nguyen K, Reeves A, Argent V, Finck A, et al. Early human milk fortification in infants born extremely preterm: A randomized trial. Pediatrics 2023;152:e2023061603.