

Nutrition of preterm infants after hospital discharge

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Preterm Infants at Risk for Long Term Morbidity

Growth Restriction/ Failure

- Intellectual Disability
- Cerebral palsy
- Hearing and Visual Deficits
- Chronic Lung Disease
- Feeding and Digestive problems

Discharge process

The discharge process is individualized and the decision depends on:

- The health status of the individual child
- Its capacity to feed and retain its feed
- Its weight and growth rate
- The estimations of the treating medical professional
 - Physiologic maturity
 - Cardio-pulmonary stability
 - Ability to maintain body temperature (out of incubator)
 - Ability to consume ad libitum quantities of human milk or formula
- Estimating the family's capacity providing care....

In many neonatal units, stable VLBW and ELBW infants are discharged from hospital care at postconceptional ages of about 35 to 36 weeks and/or with body weights of about 1800-2000g



Background

- Preterm infants, especially those with very low birth weight, are more susceptible to nutritional deficiencies and growth restriction after hospital discharge than term infants:

Physiological immaturity

High metabolic demands

Unstable medical condition

Small endogenous nutrient reserves (glycogen, fat)

- It may compromise their long term growth and neurodevelopment

Infants at highest risk post discharge

- VLBW and ELBW
- Small for gestational age (SGA) and Intrauterine Growth Retardation (IUGR)
- Primarily breastfeeding with no fortification
- Infants on special formulas
- Infants who require tube feedings at home
- Infants on total parenteral nutrition (TPN) > 4 weeks during hospitalization
- Infants with gastrostomies
- Infants with slow weight gain **prior to hospital discharge** (gaining less than 15 gm/kg/day)
- Infants with any of the following complications of prematurity:
 - o Bronchopulmonary dysplasia/chronic lung disease
 - o Chronic renal insufficiency
 - o Congenital alimentary track anomalies
 - o Short bowel syndrome
 - o Cyanotic congenital heart disease
 - o Osteopenia of prematurity
 - o Anemia of prematurity
 - o Severe neurological impairments
 - o Drug and/or alcohol exposure in utero
 - o Poverty or low socioeconomic status

Preterm infants at risk for growth retardation and need of recovery growth at discharge

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- Prematurity & significantly greater MEE* of ELBW compared to term infants at the time of discharge
- Inadequate intake as result of unstable medical condition, immature GI function, poor tolerance

Cause that at the time of discharge, many preterm infants have a high risk of :

- Cumulative deficits in the accretion of energy, protein
- Low body stores of nutrients
- Deficient bone mineralization

Resulting in higher nutrient requirements than healthy term infants

Therefore, the question has arisen whether such infants require special nutritional regimens or special discharge formulas

Nutrient Deficits Impacting Growth in Preterm infants

Energy and Protein Deficits: Lean Tissue growth

- Mineral deficiency: Low bone Mineral content
- Zinc deficiency :Lean mass accretion
- Iron deficiency Anemia & poor growth

Factors Related to Full Scale IQ at Age 8

HC at Birth : NO

- HC Growth

Between Birth and 1 year: YES

Between 1 and 4 years: NO

Between 4 and 8 years: NO

First Year of Life A critical window for growth

nutritional recommendations for preterm infants

- Is heterogeneous and controversial
- Are mainly directed at hospitalized preterm infants without considering recovery and growth required in the first years of life

nutritional recommendations

- energy and nutrient recommendations for preterm infants born with VLBW should be higher than those prescribed for term infants after hospital discharge

International recommendation



The ESPGHAN Committee on Nutrition issued a commentary on the feeding regimen of preterm infants after hospital discharge in 2006

Infants with an appropriate weight for postconceptional age at discharge:

- ✓ Breastfed when possible
- ✓ Standard infant formula with LCPUFA

Infants discharged with or at risk of growth failure :

- ✓ Supplemented maternal milk
- ✓ A special post discharge formula, with high contents of protein, minerals and trace elements, PUFA







Aim

- recover the growth deficit that may have occurred during the intra and extra-uterine periods.
- to allow preterm infants to “catch up” to infants born at term.
- particular attention should be given to dietary protein and energy intakes.

- evolution of preterm growth may vary depending on the type of population, degree of prematurity, presence or absence of BPD ,and degree of restriction of postnatal growth before the start of catch-up growth
- Nutritional management during the follow up of preterm infants should be guided more by the assessment of the nutritional status and *current* clinical conditions presented by the preterm infant than by the conditions recorded at birth.








Nutrient Needs Of VLBW Infants &Types of Post Discharge Nutrition

Recommended Macronutrient/Micronutrient Requirements (units/kg/d) for Preterm Infant

	Term	VLBW	VLBW Post Term
Energy, kcal	90–120	110–130	90–100
Protein, g	1.52	3.4–4.2	2.0 
Carbohydrate, g	16–20	7–17	6.8–14.1
Fat, g	8–10.3	5.3–7.2	4.0–6.6
Vitamin A, IU	1333	700–1500	545–1273
Vitamin D, IU	200	150–400	400 
Calcium, mg	70–120	100–220	253–377 
Phosphorus, mg	35–75	60–140	105–273 
Iron, mg	0.09	2–4	1.8–2.7 
Zinc, µg	666	1000–3000	890 

- Caloric intake 130 kcal/kg/day and protein intake > 3.5 g/kg/day appear to be adequate only for VLBW premature infants over the first year of life (CA)

Nutrients Comparison between Mature Human Milk and Target Needs For Preterm infant at Discharge

	Target	Human Milk
Calories/kg	120–130	138
Protein g/kg	2.5–3.5	2.0 
Fat g/kg	6.0–8.0	7.8
CHO g/kg	10–14	13.2
Vitamin A IU/kg	1000	780 
Vitamin D IU	200–400	4 
Vitamin E IU/kg	6–12	2.0 
Ca mg/kg	150–175	50 
P mg/kg	90–105	26 
Fe mg/kg	2–4	0.2 

AAP Committee on Nutrition Recommendation

Calcium : 150 to 220 mg/kg/day

- Phosphorus: 75 to 140 mg/kg/day
- Vitamin D: 400 IU/day
- Iron: 2-4mg/kg/day

- use of mother's own milk for preterm infants both pre- and post-discharge is rightly unchallenged
- + Fortification
- Cows Milk derived or Human Milk Derived

Certain preterm infants may particularly benefit from POST DISCHARGE FORMULAS

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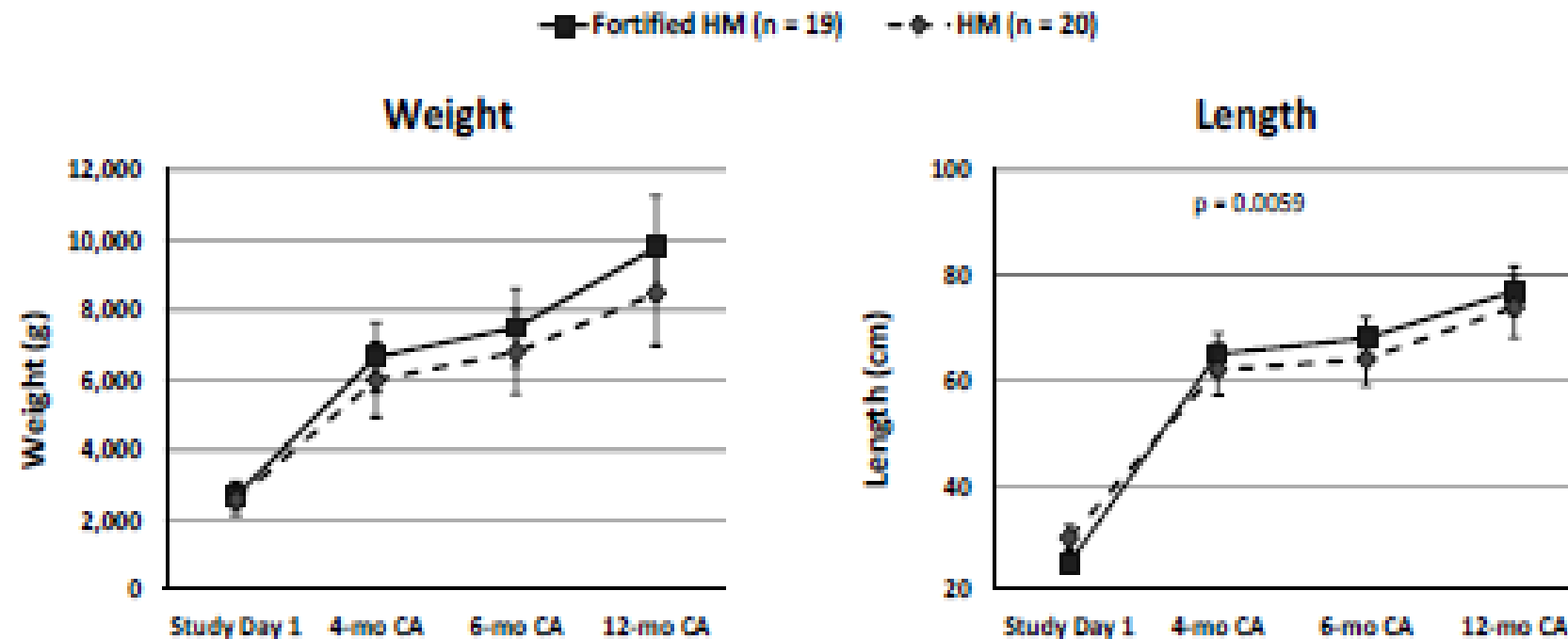
Preterm infants who:

- ☑ Born with or less than 1500 gr body weight
- ☑ Discharged with less than 2000 gr body weight
- ☑ Need recovery growth, that is prevailing effects of intrauterine growth retardation and/or accumulated extrauterine growth retardation and has fallen below the 10th percentile on growth reference charts
- ☑ Discharged relatively long before its expected date of delivery
- ☑ With persistent co-morbidities and subsequent growth faltering
- ☑ With **nutritional deficiencies**



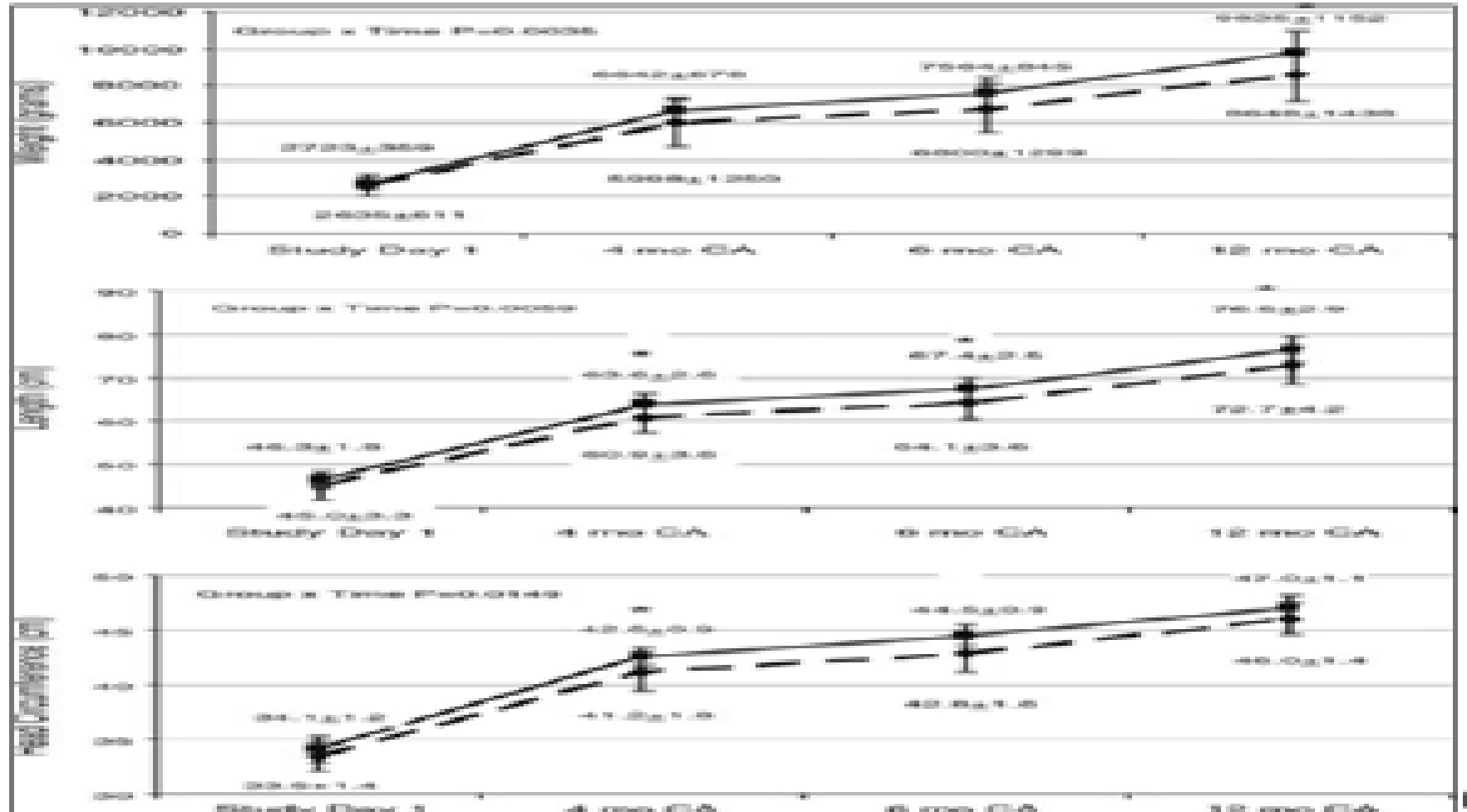
Review of Current Evidence of Post Discharge Nutrition on Neonatal Outcomes

Fortified HM Post Discharge Improves Growth Outcomes in 1st Year of Life

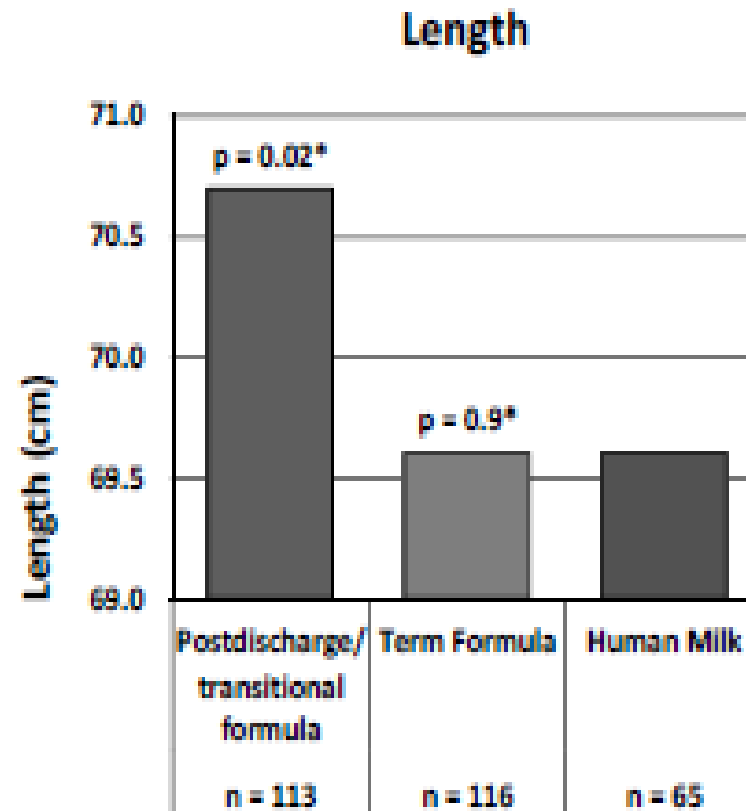
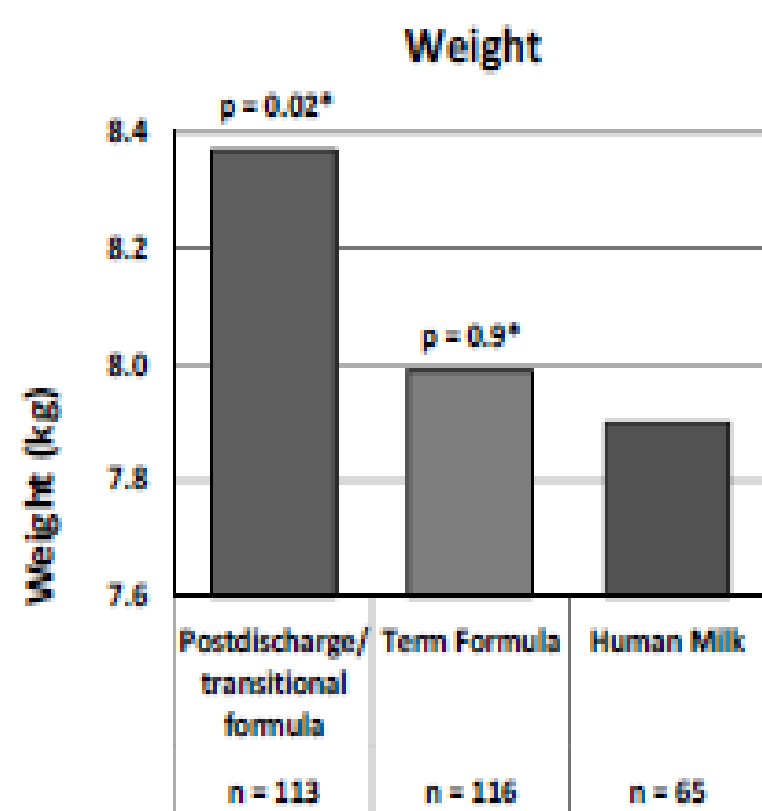


CA = Corrected Age

Fortified HM Post Discharge Improves Growth Outcomes in 1st Year of life

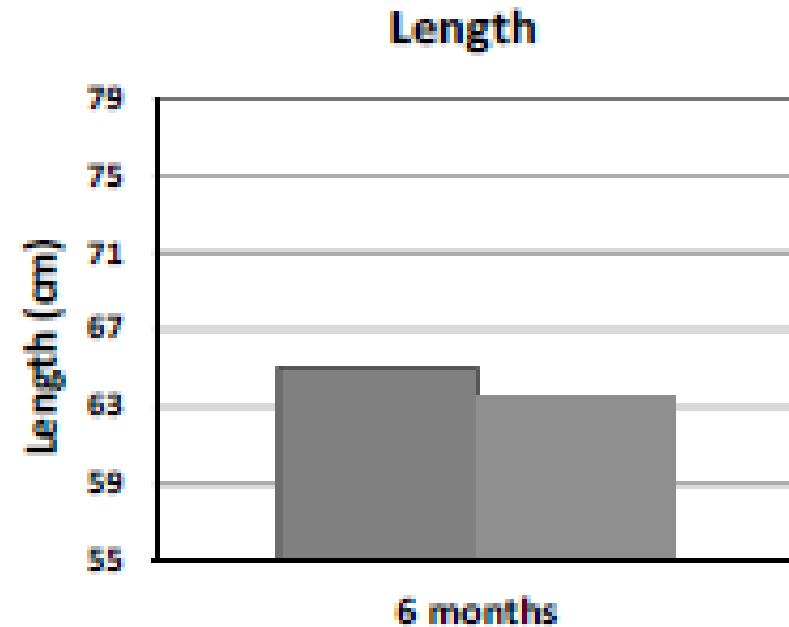
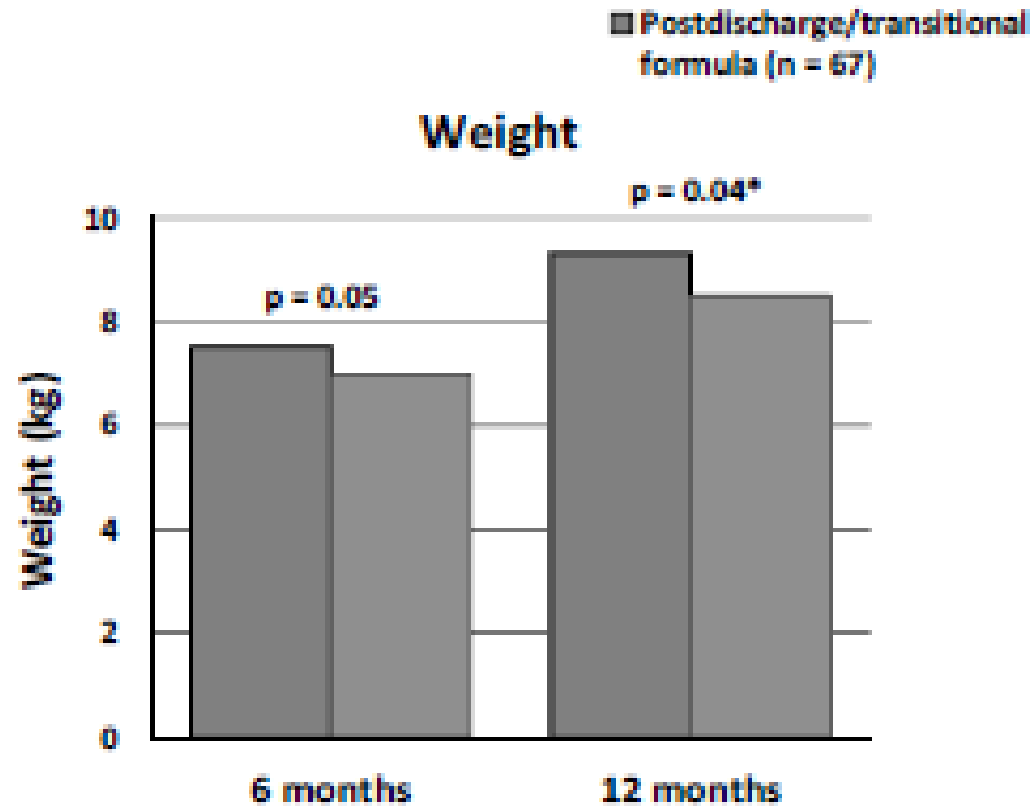


Enhanced Growth in PT Infants Fed Post Discharge Formula vs Term Formula or HM



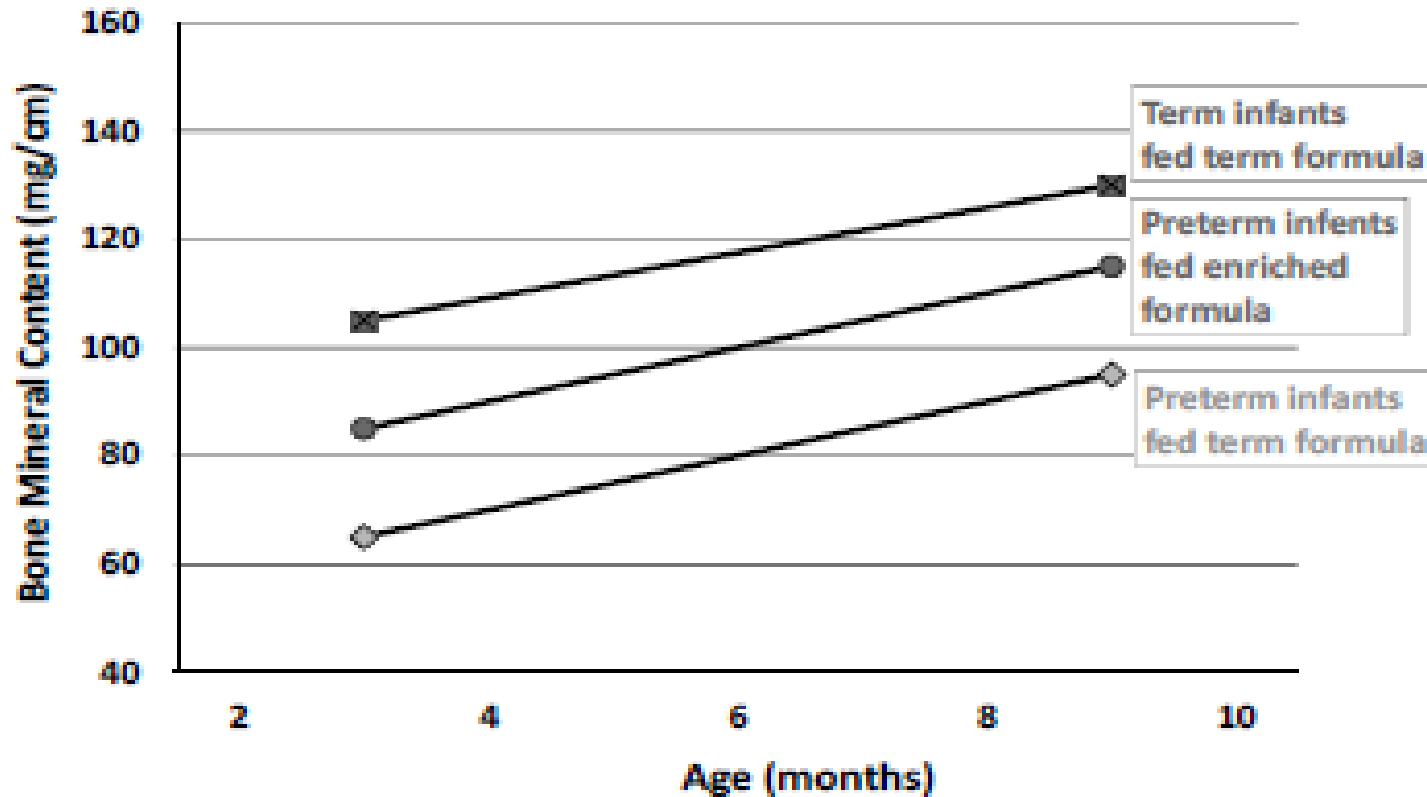
*Compared to human milk

Feeding Post Discharge Formula & Growth in 1st Year of Life



*Male infants

Nutrient Enriched Formula Post Discharge Increase Bone Mineral Content in Preterm Infants



Summary on Use of Nutrient Enriched Formulas after Discharge

- Randomized controlled Trials, showing improved growth
- Improved growth was paralleled by increase in lean mass (not fractional fat mass) and bone mineral content

Effects on growth was not sustained and was impacted by high requirement for catch up growth based on individual BW and GA

The evidence for sustained long term improved neurodevelopmental outcomes with use of PDF is minimal.

Growth of Preterm Infants at Discharge: 4 Different Patterns

1. Infants with BW and DW appropriate for PCA (appropriate growth)
- 2. Infant born AGA but DW below reference growth curve (post natal growth restriction)**
- 3. Infants born SGA & have DW still below the reference curve (IUGR)**
4. Infants born SGA but DW is AGA (Early post-natal catch up growth): risk for Metabolic syndrome

Catch Up Growth in Preterm Infants

Crucial catch up growth occurs in the first 2 years of life

- Rates of catch up growth is affected by degree of prematurity, clinical course, neurologic impairment & nutritional intake.
- Accelerated catch up growth leads to better neurodevelopmental outcomes and current literature suggest growth b/w birth and 12-18 months post-term has NO effect on BP & metabolic syndrome
- Early nutritional programming leading to long term outcomes during late infancy/childhood & benefit vs risks is unknown and needs further study.

“BALANCED GROWTH”

RECOMMENDATIONS

ESPGHAN Committee on Nutrition

1. VLBW infants discharged with a subnormal weight for postconceptional age are at increased risk for long-term growth failure.
2. Formula-fed infants should receive a special PDF after hospital discharge.
3. The human milk fed infants should be supplemented, with a human milk fortifier up to 52 weeks PCA

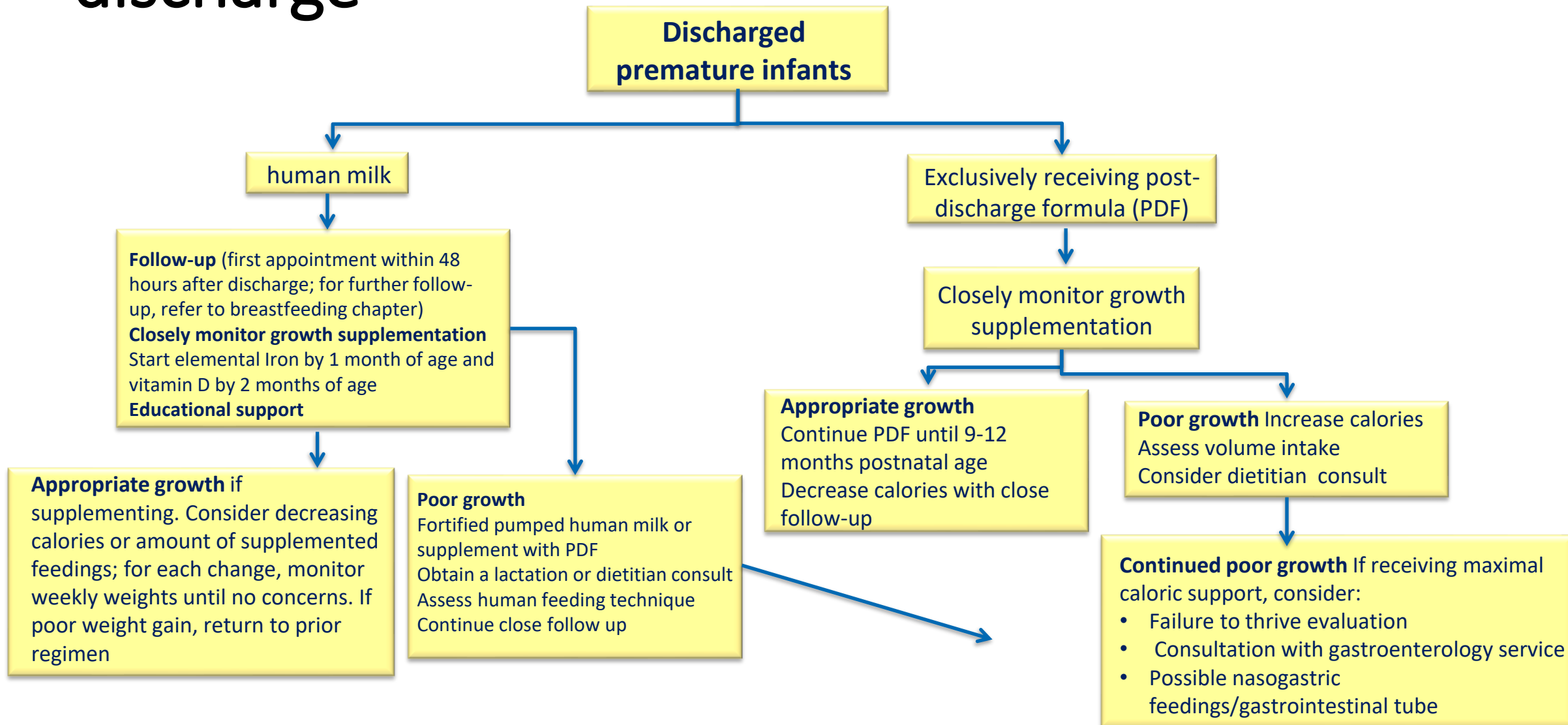
Specific Nutrient Requirements after Discharge in Preterm Infants

Estimated **protein** needs are 2.5 to 3.5g/kg/day Post discharge preterm formulas have higher **Calcium and Phosphorus** than term formulas which improves bone mineralization.

- **Vitamin A** Requirement is higher and optimized in post discharge preterm formulas
- The target intakes for **Iron, vitamin D and E** remain consistent for preterm infants after discharge and need multivitamin and Iron supplementation

Feeding chart for preterm infants after discharge

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PDF has an intermediate in composition between preterm and term formula and contains :

Increased energy (75kcal/100ml)

Increased protein (2 g/100ml)

DHA/AA, for better cognitive and visual development

20% MCT ,for better absorption of fat

Nucleotides, supporting growth & gut maturity

Unique oligosaccharides, scGOS/lcFOS, with 9/1 ratio, (0.8g/100ml)that contribute to a better feeding tolerance, growth & development, GI health

Contains extra Ca, P, Zn - necessary to promote linear growth

Additional vitamins and trace elements

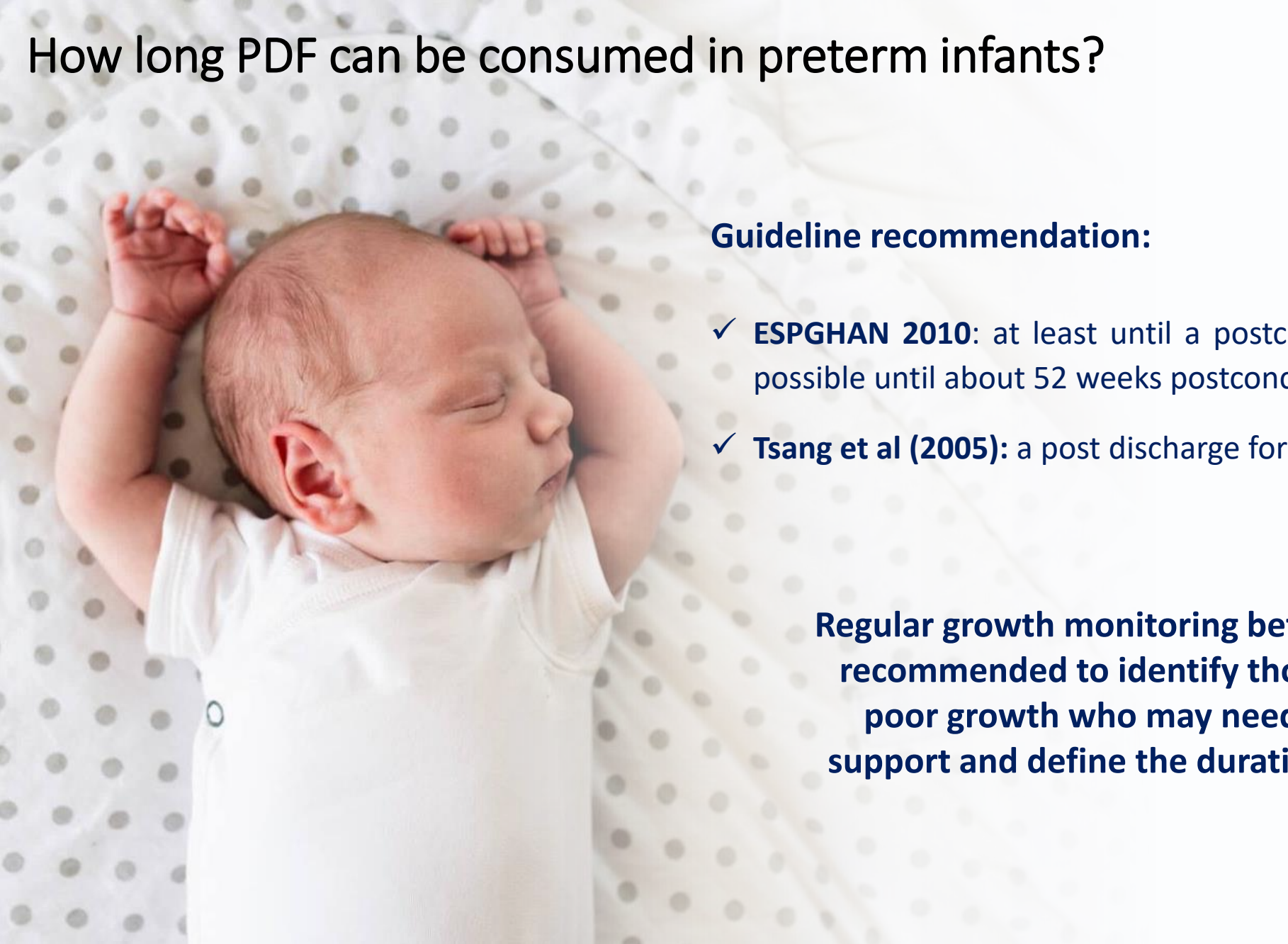


Recommendations on Post Discharge Nutritional Care

Discuss the nutritional needs of the preterm infant based on 4 growth patterns

- Routine growth monitoring with appropriate growth chart
- Provide appropriate nutritional care & F/U within 48hrs for these high risk infants

How long PDF can be consumed in preterm infants?



Guideline recommendation:

- ✓ **ESPGHAN 2010:** at least until a postconceptional age of 40 weeks but possible until about 52 weeks postconceptional age.
- ✓ **Tsang et al (2005):** a post discharge formula during the first year of life.

Regular growth monitoring before and after discharge is recommended to identify those preterm infants with poor growth who may need additional nutritional support and define the duration of growth retardation

Evidence for the advantage of enriched feedings compared to standard term infant formula in the post-discharge period, Cochrane review/ Meta-analysis



Contents lists available at [ScienceDirect](#)

Clinical Nutrition

35 (2016) 791e801

journal homepage: <http://www.elsevier.com/locate/clnu>

Review

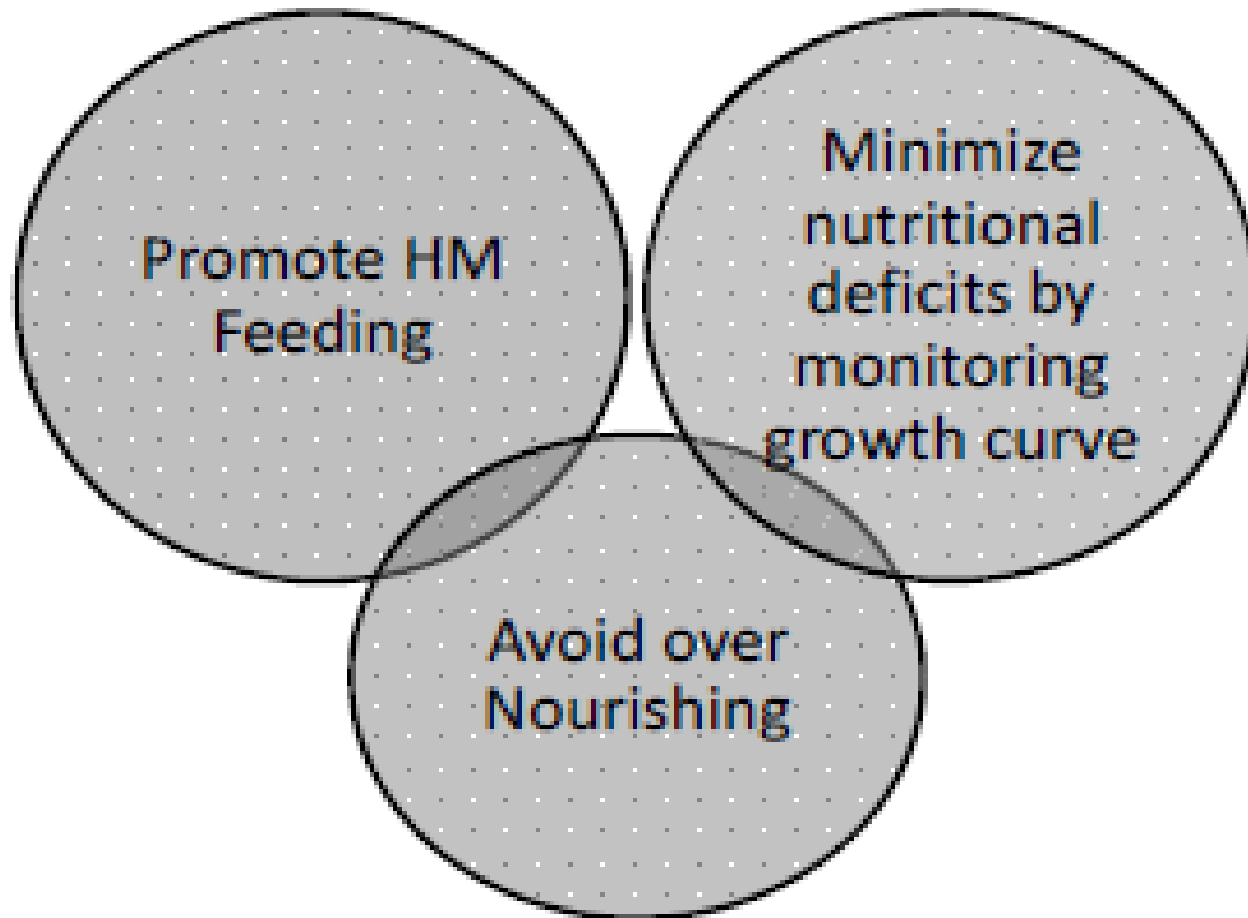
Post-discharge formula feeding in preterm infants: A systematic review mapping evidence about the role of macronutrient enrichment

Inga C. Teller ^{a,*}, Nicholas D. Embleton ^b, Ian J. Griffin ^c, Ruurd M. van Elburg ^{a,d,1}

CONCLUSION:

Feeding PDF with a Protein-Energy ratio > 2.5 to preterm infants in need of recovery growth for up to six months results in improved weight, and particularly lengths, and head circumference at 3, 6, 12, months corrected age, favorable body composition development and improved metabolic markers at 24 months of age

GOALS FOR POST- DISCHARGE NUTRITION IN PRETERM INFANTS



Summary

Recommendations for Post-Discharge

Nutrition of the VLBW Infant

An **individualized approach** is essential for the post-discharge nutrition of the VLBW infant

Human milk is preferred for preterm infants and breast-feeding should be advocated by pediatricians and lactation resources should be made available

Before going home, a **discharge nutrition plan** should be discussed among the health care team, parents, and, if possible, the outpatient care provider

Summary

Recommendations for Post-Discharge Nutrition of the VLBW Infant

Post-discharge nutrition needs may be met by **human milk/human milk supplemented with post-discharge formula, or exclusively postdischarge** or term formula as systematic reviews have shown benefit in growth but minimal benefit on neurologic outcomes

Close monitoring of growth parameters using validated growth curves and nutritional intake should be assessed at discharge and every 2 to 4 weeks thereafter, until stable weight gain is established

Post Discharge Nutrition of Breast Fed Preterm Infant

Growth of PT on BM post-discharge should be closely monitored
Human milk fed PT infants who are not meeting their growth targets will benefit from multivitamin fortification of a portion of their daily feeds

Preterm Infant fed human milk require supplementation with vitamin D & Iron until 1 year CA (age from expected date of delivery)

Complimentary food should start not later than 6months CA

Take home message

Preterm infants are at risk for **growth failure** in immediate post discharge period

- Develop a **PROACTIVE** rather REACTIVE approach in supporting breastfed preterm Infant
- There is **window of catch up growth** within 1st year of life in which linear and ND outcomes can be affected
- Strategy to **monitor growth & development** post discharge is crucial
- This **Strategy should be individualized** as nutritional needs in VLBW infants are wide ranging.

Thanks for your attention

