Preterm Dietary Supplements

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IAP Neocon, Mumbai 2015

Preterm VLBW Nutrition : Ideal practice

Minimal enteral feeds (10 ml / kg / day)

Human breast milk

Feed advancement @ 20 ml / kg / day

Human milk fortification 100 ml / kg /day

Parenteral nutrition (ELBW < 1000 g)

Aminoacids	1 – 1.5 g / kg / day	Day 1
Lipids	1 – 2 g / kg / day	Day 1-3

Ziegler EE –J Mat – Fed – Neonatal Med, Mar 2009

Case, Baby of MI 28 wks, BW 1280 gms

DAYS	NUTRITION
DAY 1	TPN (1.5 g amino acids; 1.5 g lipids)
DAY 2	Minimal Enteral Feeding
DAY 2-8	Grading up of feeds
	HMF started
DAY 9-30	Fortified milk- full feeds
DAY 33-34	Sodium supplementation
DAY 30- 35	Transition to oral feeds- discharge

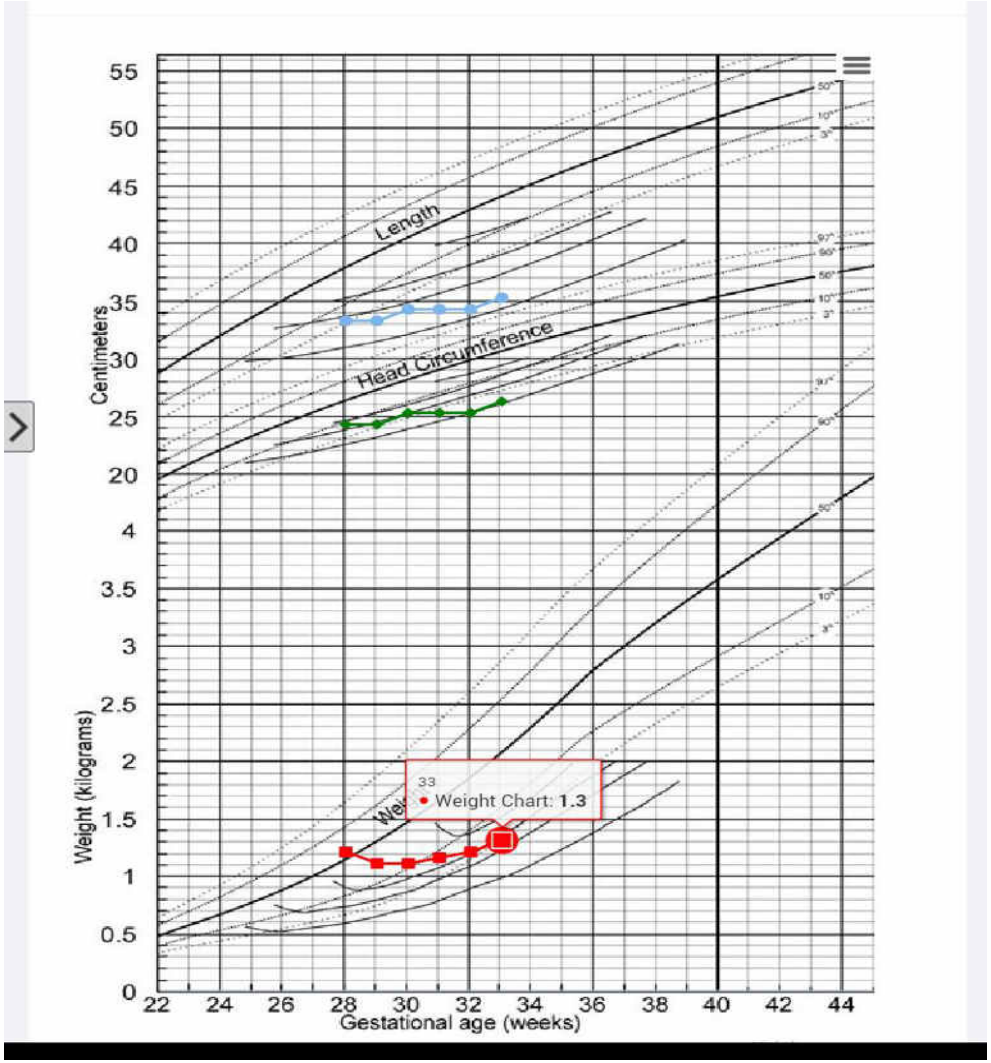
Weight gain: Day 9 –30 - 10 gms / day

Initial birth weight: 1280 gms

Birth weight regained on day 34

Birth centile : 30 th (Fenton)

Discharge centile : 3 rd

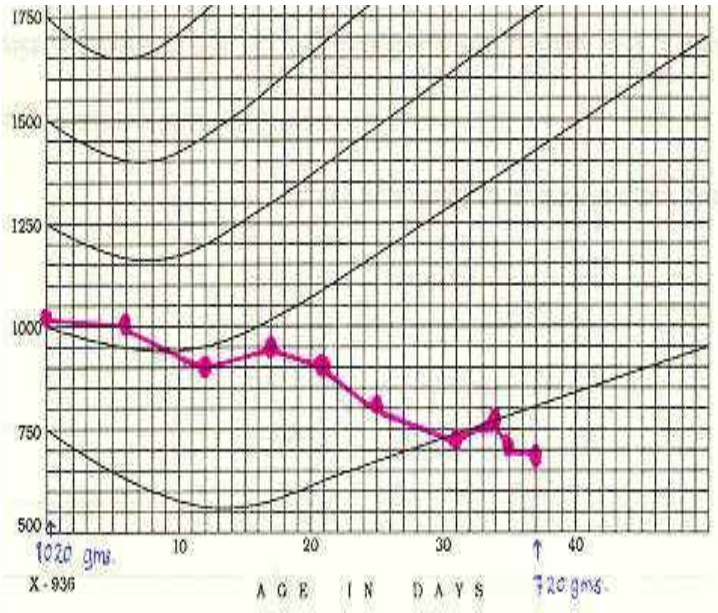


Extrauterine growth retardation – EUGR

Born at 28 wks, BW 1020 gm

RDS / Pulmonary morbidity

Wt at 1 month 720 gm



EUGR - A serious problem in preterms

Preterms 23 – 34 weeks, 24371 Preterms

Growth < 10th percentile at 40 weeks

WT	28 %
LNTH	34 %
HC	16 %

Possible neurologic and sensory handicaps

Clark RH, Thomas P, Peabody J, Pediatrics 2003

CONSEQUENCES OF INADEQUATE EARLY NUTRITION

Post-natal Growth Restriction - a global concern

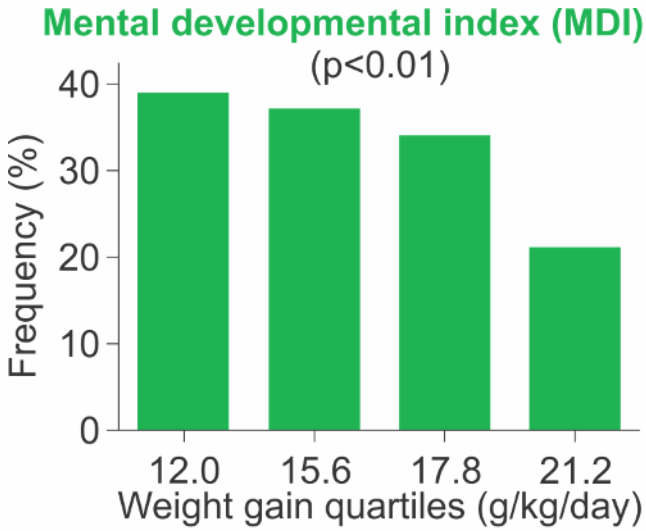
Vulnerable periods

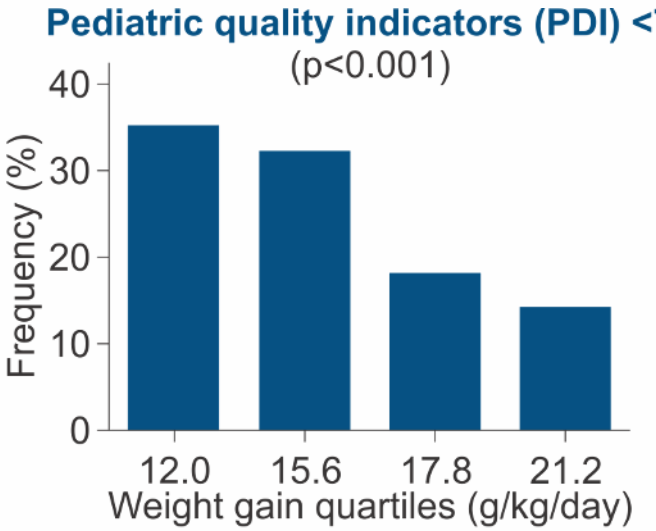
Nutritional insults – impaired somatic growth

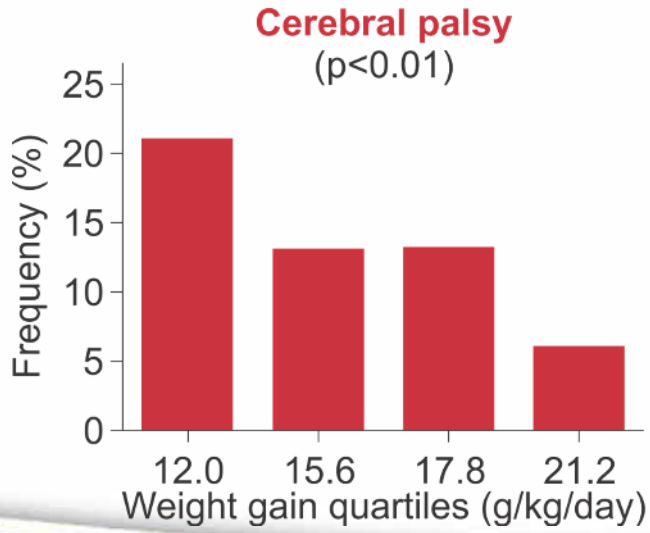
Impaired neuro-cognitive development

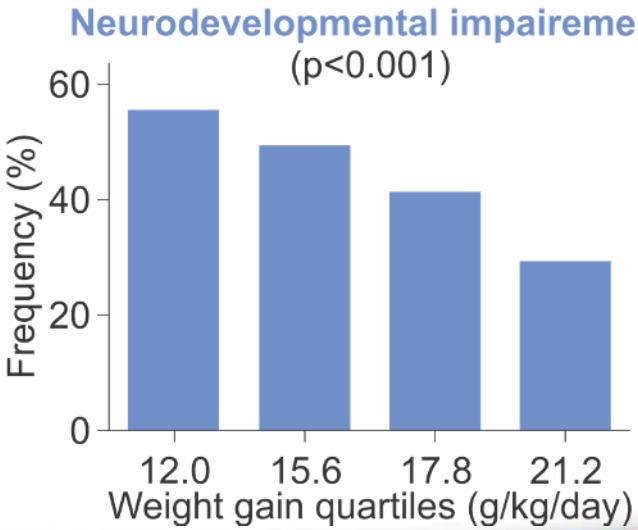
Ehrenkranz et al Pediatrics 2006

In-hospital Growth Velocity and Neurodevelopmental Outcomes

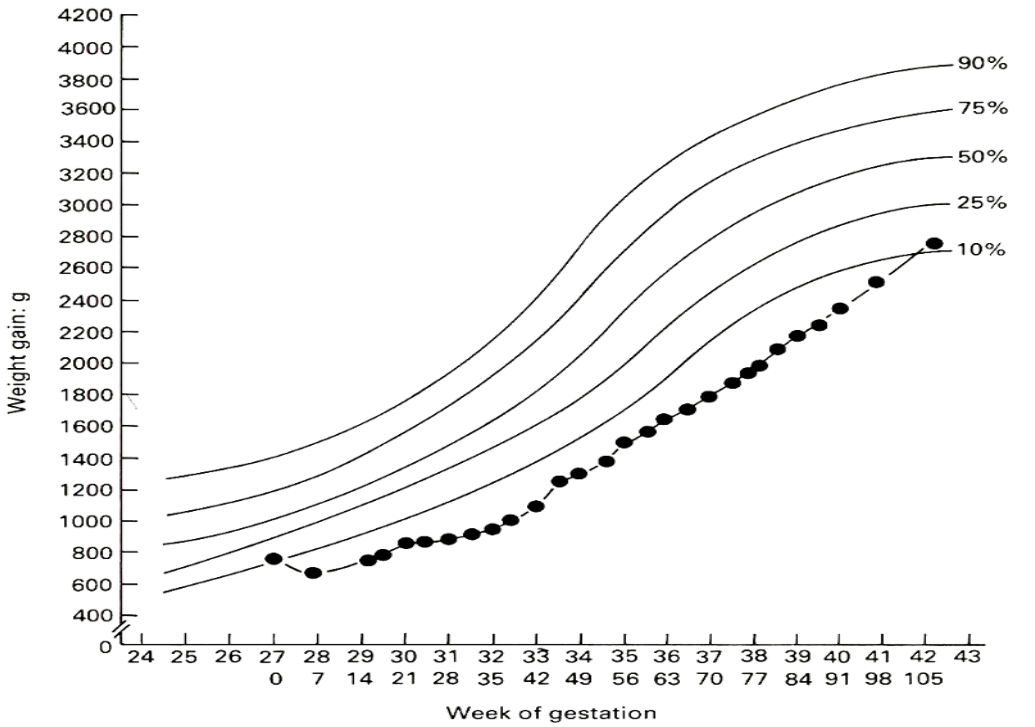






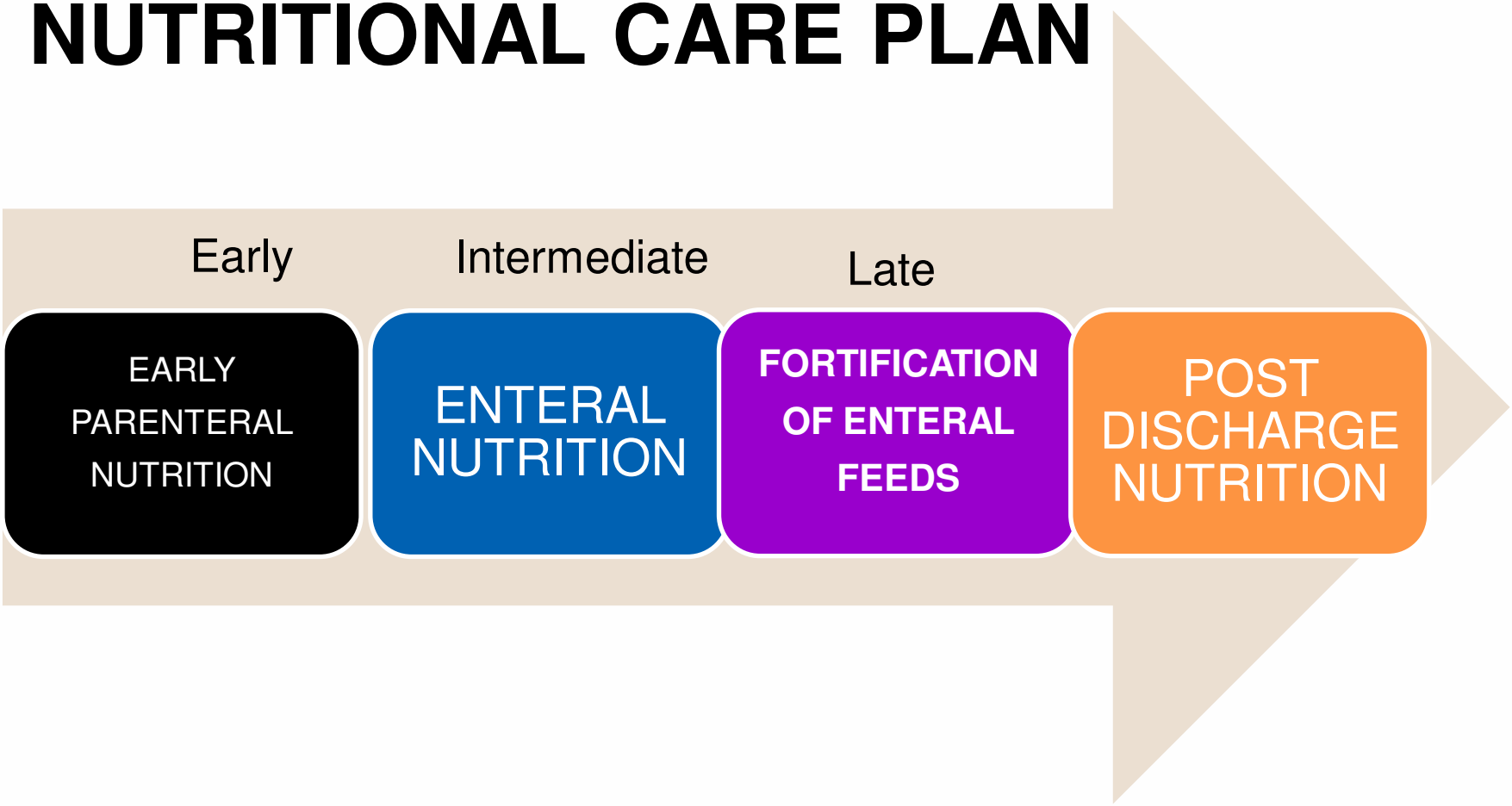


DEFINING GROWTH TARGETS



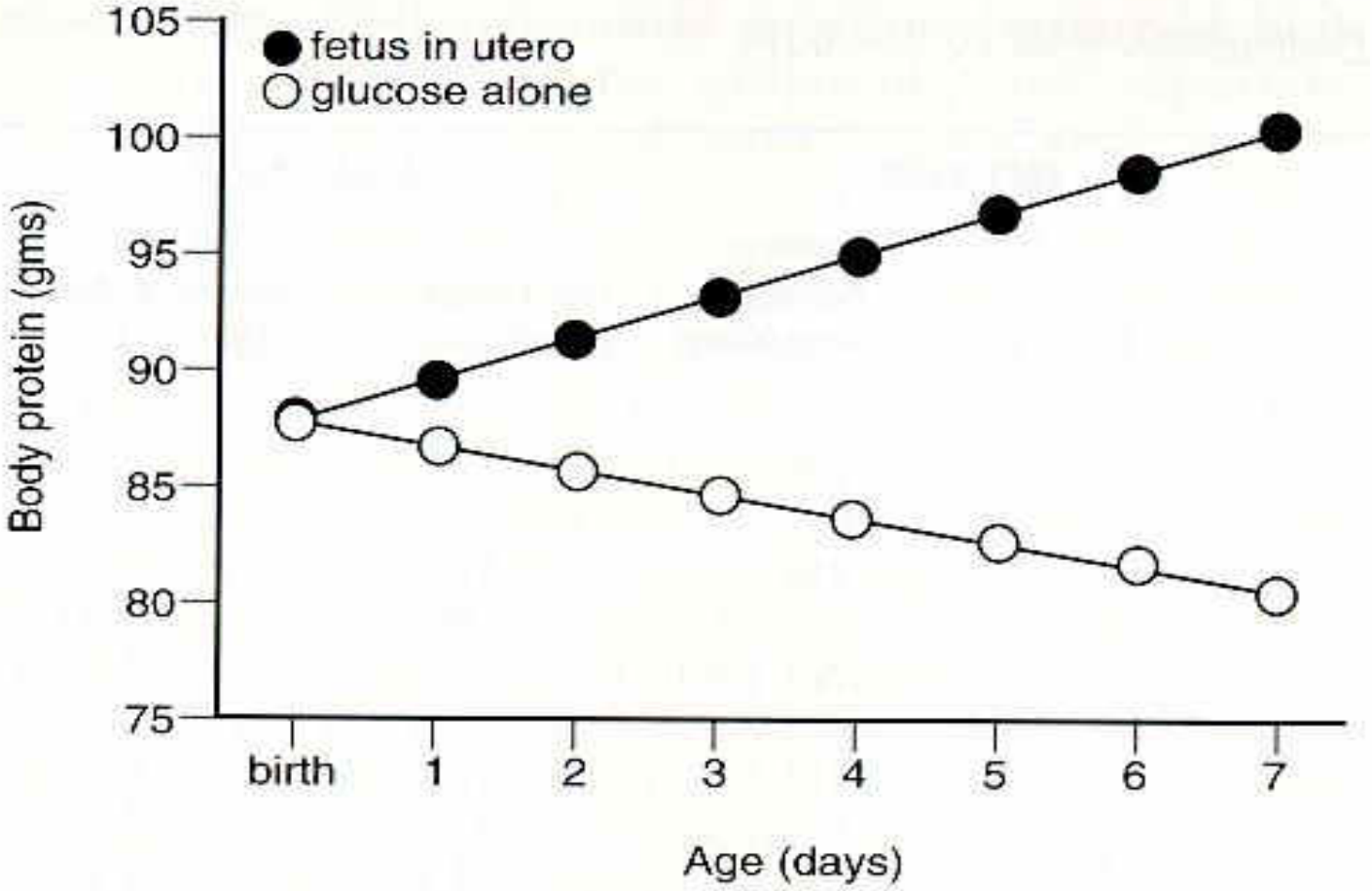
Weight gain 10-15 gm/kg/day
Length gain 0.75-1 cm/wk
HC gain 0.75 cm/wk

NUTRITIONAL CARE PLAN



1.

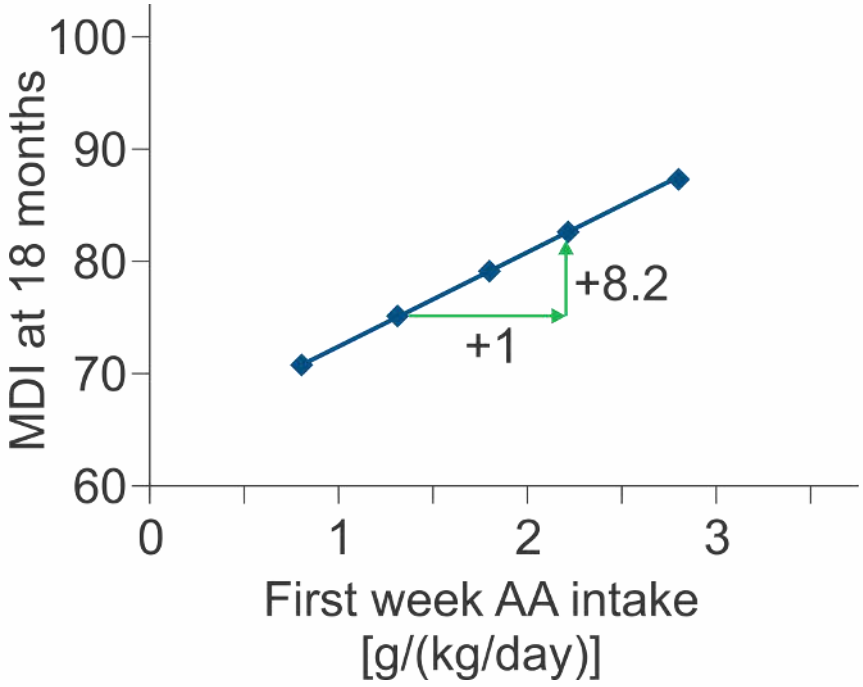
GLUCOSE ALONE AS NUTRITION (26 weeks, 1000g)

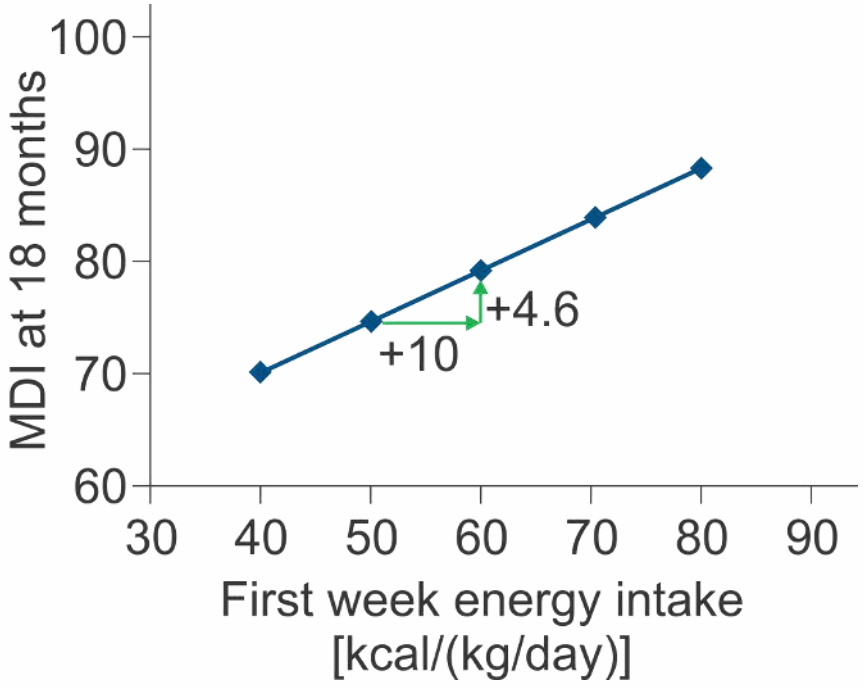


Denne SC, J Clin Invest 1996

First Week Protein and Energy Intake and Neurodevelopmental Outcomes

- Retrospective study of 124 ELBW infants at 18 months CA
- AA intake 1st week: 1.8±0.4 g/kg/day
- Energy intake 1st week: 60±8 kcal/kg/day





Stephen BE

EARLY AGGRESSIVE PN

Current recommendation

Day 1 — Min AA 1.5 g/kg (3 g / kg preferred)

Started within 1 hr of birth

Increase to 4 g / kg within few days

LIPIDS 1 – 2 g / kg Day 1

Several studies (AA 3.5 g / kg , Lipids 3 g / kg)

No increase in BUN, lipids, acidosis

Uhing MR Clin Perinatol 2009

MINIMAL ENTERAL FEEDING

- EBM 8 -12 ml / kg , 3-6 hrly, starting 1-3 hrs after birth
- Preferably with EBM / Donor Human milk

GRADING UP FEEDS

Increments of at least 20 ml / kg / day (Full feeds Day 7)

Caution in babies < 750 g and SGA infants as data limited

(Cochrane Systematic Review 2011)

Human Milk Banking

A National mission

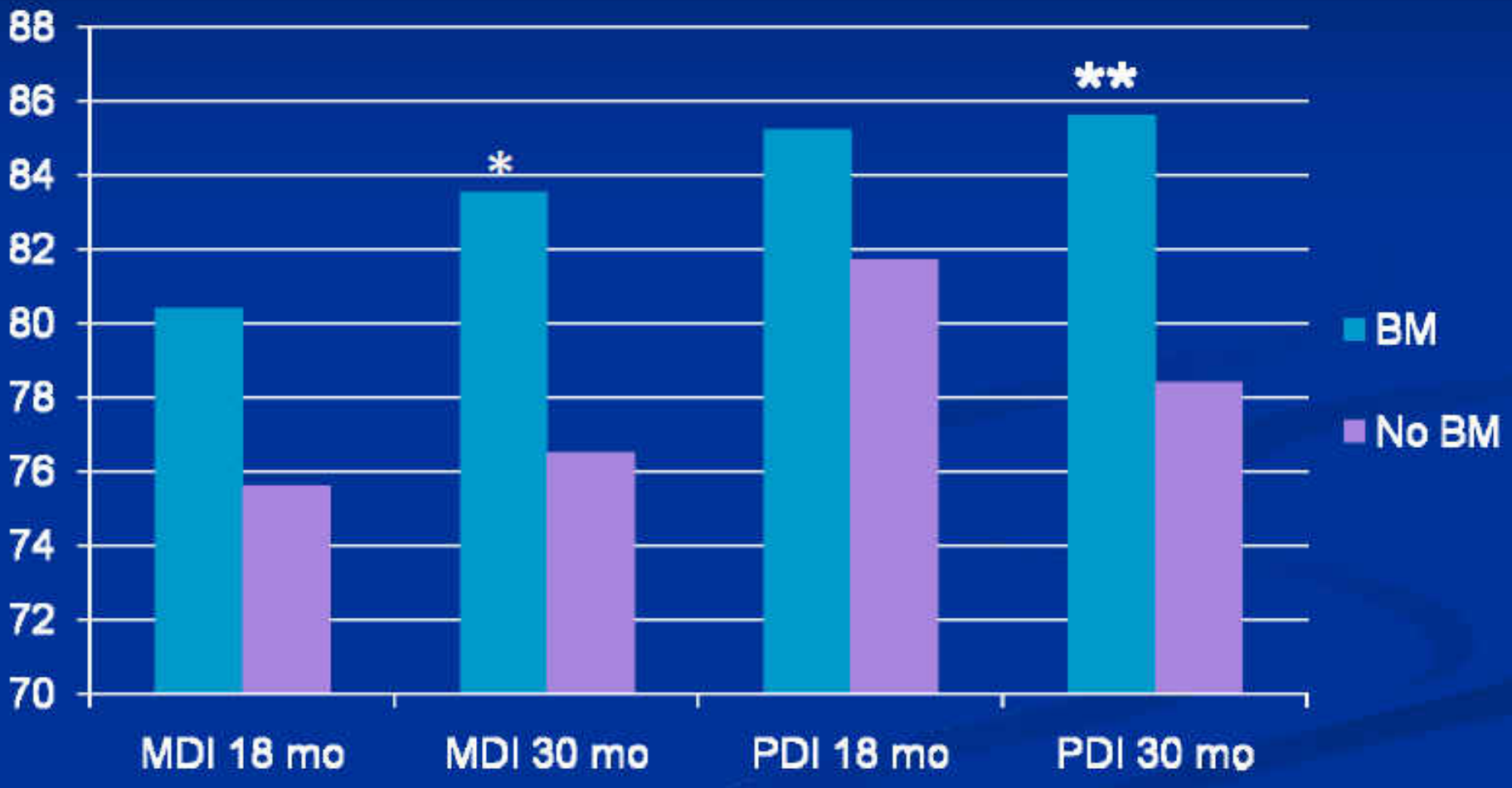
Network of Human Milk Banking

Effect of human milk feeding on morbidity & hospital stay

	Human Milk > 50 ml/kg/d	Human milk and formula	Preterm formula
No.infants	62	63	42
Human milk intake	96 + 23	20 ± 15	0
NEC n(%)	1(2%)	16(25%)	6(13%)
Late onset sepsis (LOS) n (%) **	19(31%)	29(45%)	22(48%)
LOS & NEC n(%)	19(31%)	35(56%)	25(54%)
Hosp stay days ***	73 ± 19	87 ± 43	88 ± 47

Schanler , et al . Pediatrics 1999; 103: 1150 – 57
*B. Wt . 1000 g GA < 30 wks, *p < 0.01, ** p < 0.07, ***p < 0.05*

Mean MDI and PDI scores for ELBW infants at 18 & 30 months age



* p = .03, ** p = .008

Enteral nutrient supply for preterm Infants : Commentary ESPGHAN Committee on Nutrition

- Fluid: 110-200 ml/kg/d
- Energy intake 110-135 kcal/kg/d
- Protein intake 3.5 –4.5 g/kg/d (much higher)
- Fat intake 4.4 – 6.6 g/kg/d
- CHO intake 11.5 - 16 g/kg/d

J Pediatric Gastroenterology & Nutrition 50 : 1- 9 2010

PRETERM : ADEQUACY OF BREAST MILK ?

NUTRIENT	PRETERM MILK (PER 100ML)	EBM 200 ml / kg	Requirement	DEFICIT
Protein (g)	1.1 – 1.5	2.2 - 3.0	3.5 – 4	1.3 – 1
Calcium (mg)	20	40	120 – 140	80 – 100
Phosphorus (mg)	15	30	60 – 90	30 – 60
Zinc (mcg)	295	590	800 – 1200	500 – 700
Vitamin A (IU)	250	500	1400 – 2500	1000 – 2000
Vitamin D(IU)	2.2	4.4	800 – 1000	800 - 1000

Types of Fortification

Mono-component Fortification

Carbohydrates
Proteins
Fats
Calcium PO4
Iron
Vitamins

Multi-component Fortification

Combination of 2 or more nutrients

MONO- COMPONENT FORTIFICATION

Carbohydrates	no evidence available
Fats (MCT oil)	Little evidence (1 RCT) showed no effect
Proteins	4 studies 90 babies, Better short term growth Long term effects ?

MULTI-COMPONENT FORTIFICATION : The Evidence

13 studies, > 600 patients

Short term outcome

Increased wt gain 3.6 g /kg / d

Increased LNTH increment 0.12 cm / week

Increased HC 0.12 cm / week

Long term outcome

No difference in WT./LNTH/HC at 12 & 18 mths

No effects on neurodevelopmental outcome

No effects on bone mineral content

Cochrane database 2009

Problems with Standard Fortification

58 % VLBW infants receiving fortified EBM have extra – uterine growth retardation at discharge

Henrikson C et al 2009

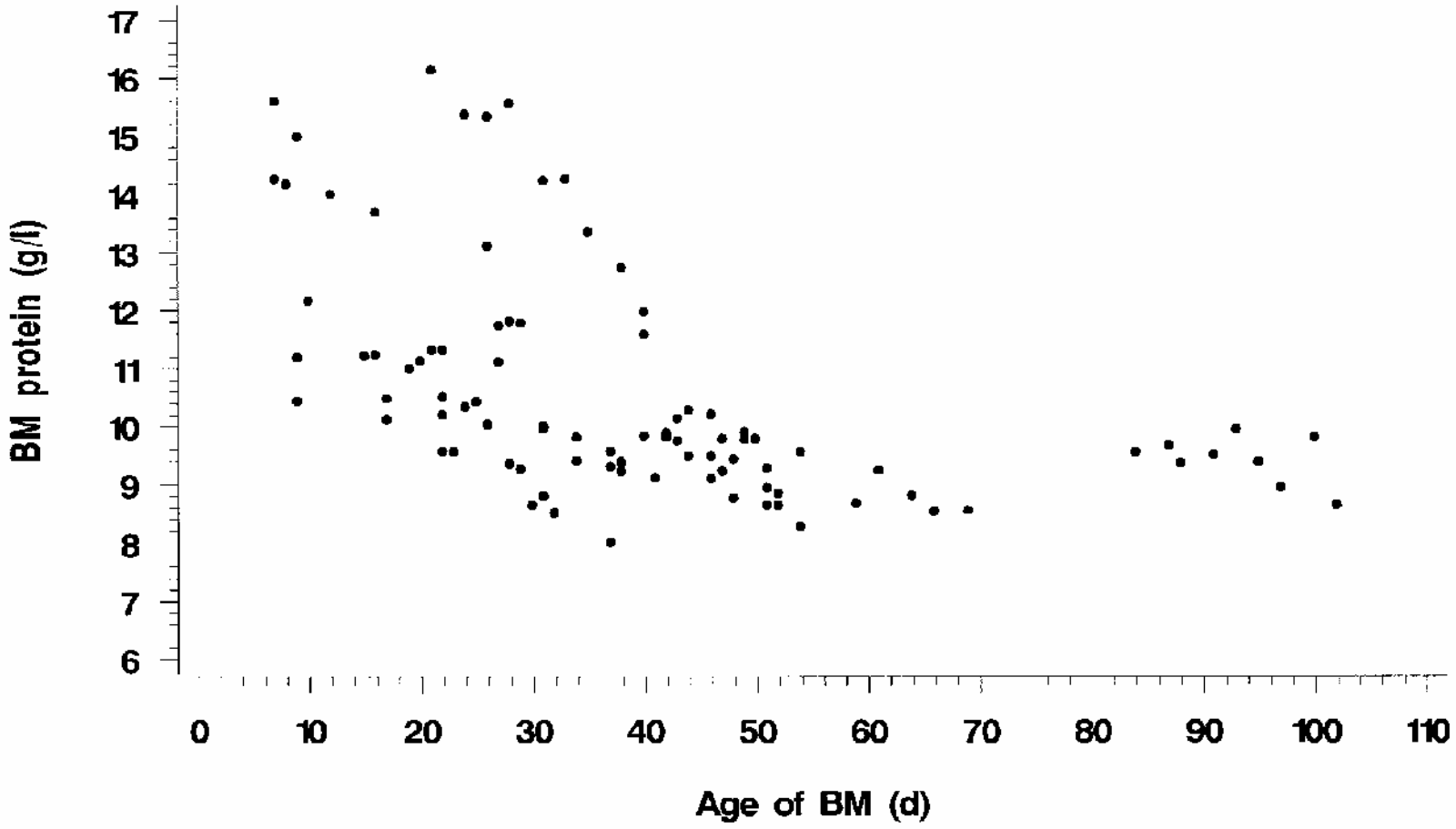
Standard Fortification – Protein deficits

Proteins is the issue !!

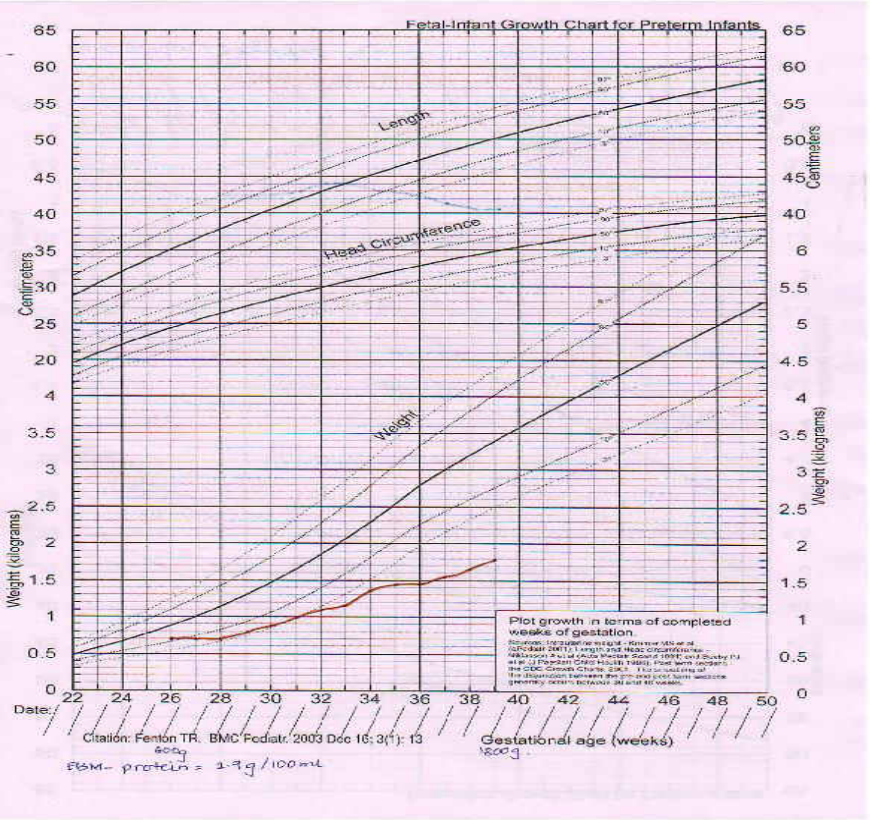
LOW PROTEIN INTAKE IS THE PRIMARY LIMITING FACTOR FOR GROWTH FAILURE

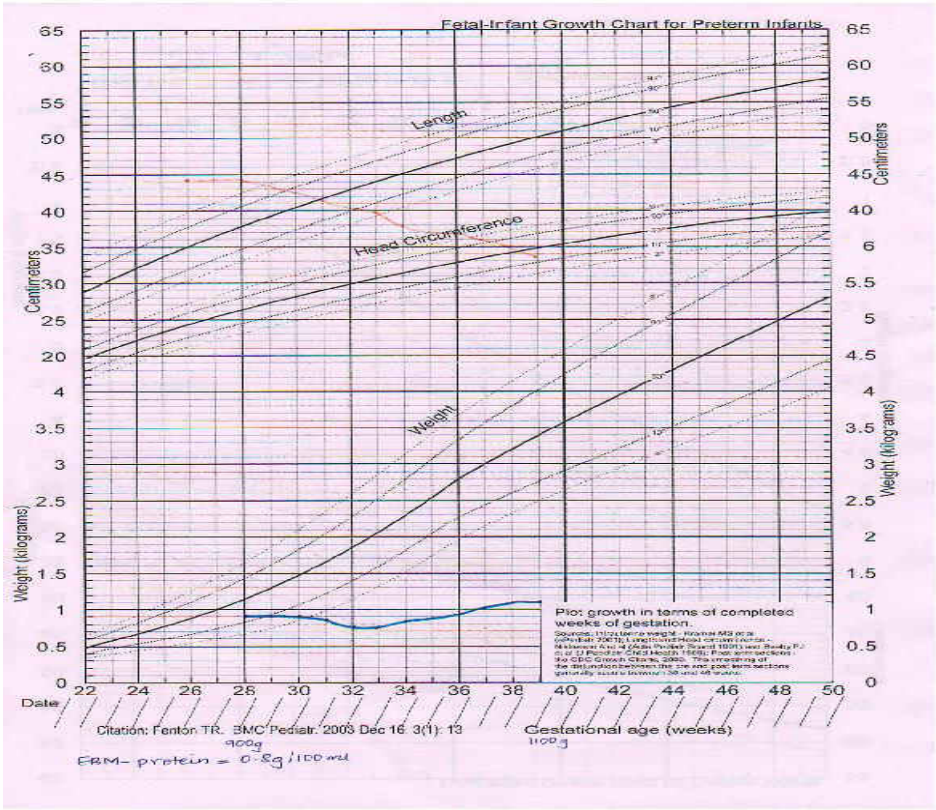
- Assumed higher protein content of human milk
- Low protein content of fortifiers
- Transition from high protein PN solutions to lower protein enteral feeds

Variable Protein Content of EBM



Variable Protein content of EBM





Baby G
EBM protein 1.9 g / 100 ml

Baby S
EBM protein 0.8 g / 100 ml

MIRIS

- Human milk analysis is essential to the health and growth of preterm babies.

- Miris Human Milk Analyser helps clinicians manage preterm nutrition quickly and simply

Protein content of Fortifiers (per gm)

Lactodex HMF (Raptakos)	0.1
Hijam (Endocura)	0.25
Enfamil HMF (MJ)	0.27
Similac HMF (Abbott)	0.25
Aptamil BMF (Milupa)	0.2
FM 85 (Nestle)	0.2

Novel Methods of Fortification

Focus on more protein

Standard Fortification	Pre-determined amount of fortifier added to EBM
Targeted Fortification	Analyse EBM for proteins and a add desired amount of fortifier to reach 3.5 g / kg /day
Adjustable Fortification	Assess protein intake by evaluation of infant's metabolic response by checking BUN (Increase dose of fortifier if BUN < 9 mg %, maintain between 9 - 14)

Recommendation & Guidelines for perinatal practice
Arslanoglou S, Moro GE, Ziegler E, J. Perinatal Med 2010

Adjustable Fortification : Turkey study

58 preterm VLBWs (<32 weeks,<1500 g)

Adjustable Fortification based on Blood urea levels

BUN	< 9 mg %	Increase Protein by 0.55 g
	14-20 mg %	Decease Protein by 0.55 g
	> 20 mg %	Stop Protein supplement

Study group 4g/kg/day versus Control group 2.78 g/kg/day

Result : Significant improvements in WT,LNTH,HC

Alan S et al, Early Human Dev 2013

Is there an alternative Protein supplement ?

Skimmed Milk Powder (SMP)

Each 100 g contains

Energy	360 kcal
Proteins	34.5 g
Fats	1 g
CHO	52 g
Calcium	1250 mg
PO4	970 mg
Sodium	500mg

SMP FORTIFICATION

(2 gm / 100 ml @ 170 ml / kg / day)

Energy kcal	126	(110 – 135)
Proteins (g)	3	(3.5 – 4)
CHO (g)	13.7	(11.6 – 13.2)
Fats (g)	7.2	(4.8 – 8.8)
Calcium (mg)	102	(120 – 140)
Phosphorus (mg)	58.5	(60 – 90)
Sodium (mg)	25.5	(69 – 115)


PROFESSIONAL
DIGITAL SCALE
OPERATION
TARE WEIGHING
Calibration
PLEASE CHECK AVAILABILITY OF WEIGHTS WITH THE STORE YOU BOUGHT THE SCALE FROM.
LT-300
Capacity:300g
Graduation:0.01g
TARE
MODE
ON/OFF

WHAT WE DO ???

NUTRITIONIST-GUIDED ENTERAL FEEDING

- Early TPN for all < 1500 g
- Minimal Enteral Nutrition with Colostrum
- Use of Expressed Breast milk /Donor milk
- Rapid grading up in stable prems (20-30 ml/kg/day)
- Fortification at 100 ml/kg/day with HMF/SMP
- Optimal calories , proteins, Vitamin D, Calcium PO4, Iron

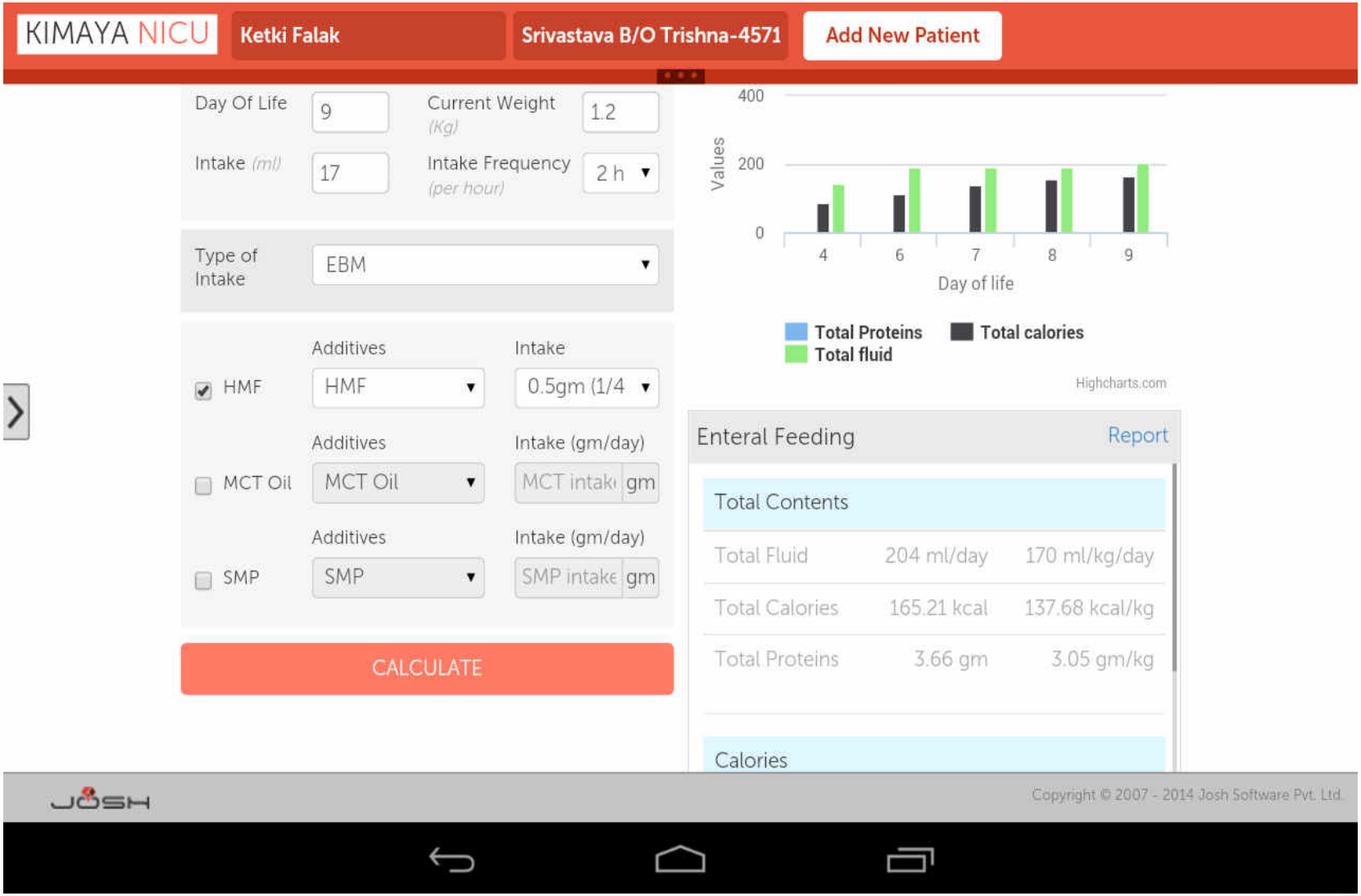
Bedside Nutrition Management Tool

Kimaya NICU Nutrition Software

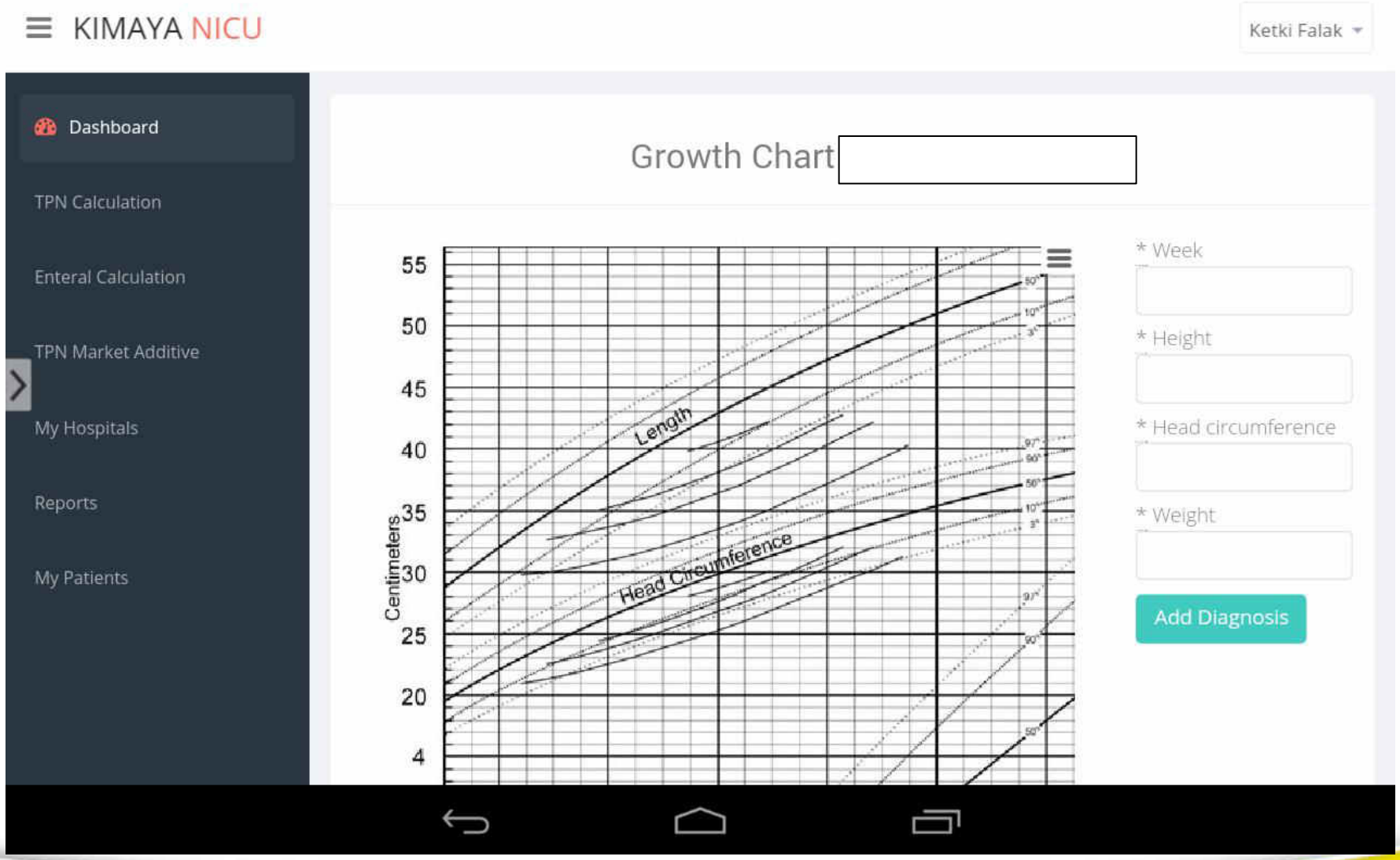
- Bedside nutrition plan
- Individualized calculations for Enteral & Parenteral Nutrition
- Linkage between EN & PN
- Helps in optimizing calorie & protein intake
- Growth chart interface

TPN Calculation

Enteral Calculation



Growth chart

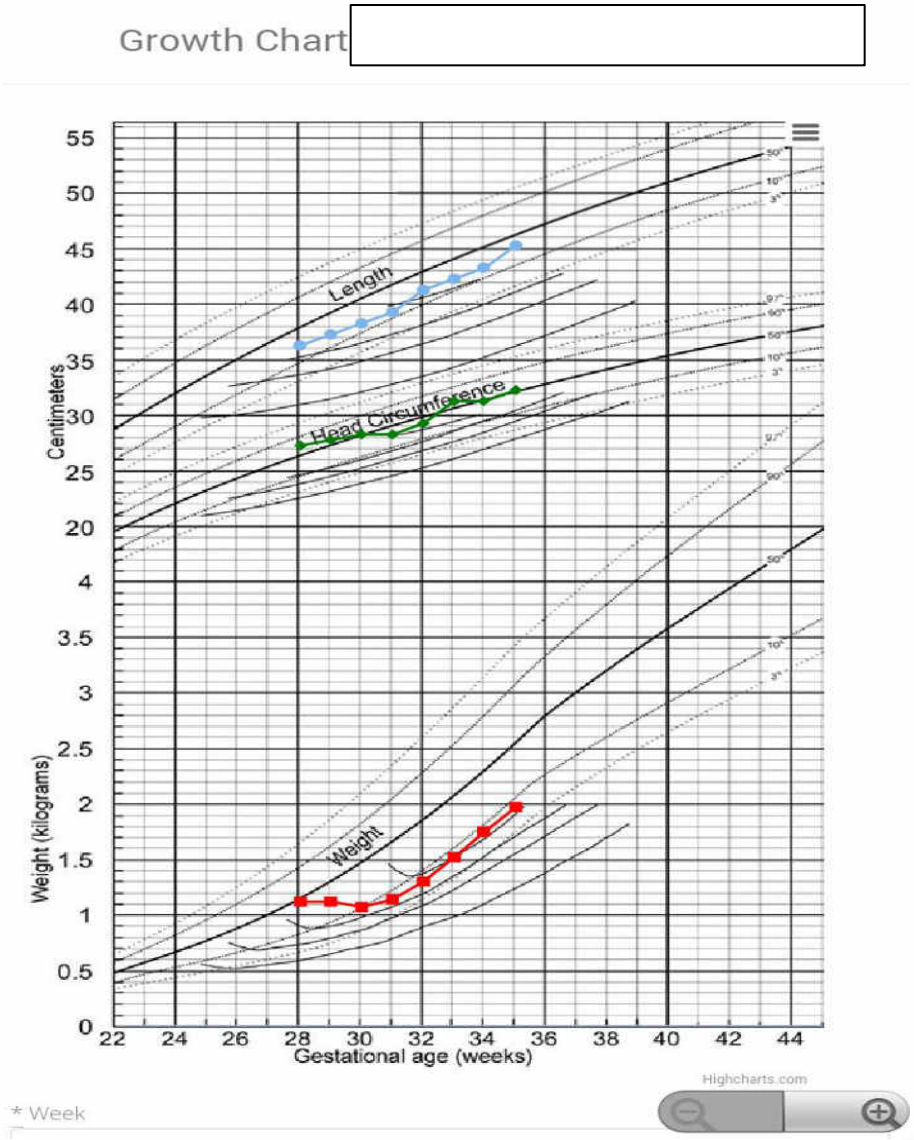


Daily Nutrition Plan

Date		Fluid (ml/kg/day)	Proteins (gm/kg/day)	Calories (kcal/kg/day)	Total Fluid (ml/kg/day)	Total Proteins (gm/kg/day)	Total Calories (kcal/kg/day)
2015-10-10	Enteral TPN	175	2.86	128.50	175	2.86	128.5
2015-10-06	Enteral TPN	177	2.89	129.85	177	2.89	129.85
2015-10-02	Enteral TPN	177	2.89	129.85	177	2.89	129.85
2015-09-30	Enteral TPN	175	2.90	129.02	175	2.9	129.02
2015-09-29	Enteral TPN	175	2.94	129.57	175	2.94	129.57
2015-09-23	Enteral TPN	163	2.90	122.52	163	2.9	122.52
2015-09-13	Enteral TPN	175	3.17	132.25	175	3.17	132.25
2015-09-04	Enteral TPN	173	3.10	130.18	173	3.1	130.18
2015-09-02	Enteral TPN	179	3.37	137.05	179	3.37	137.05
2015-08-23	Enteral TPN	140	3.46	117.06	140	3.46	117.06
2015-08-18	Enteral	174	3.49	135.32	174	3.49	135.32

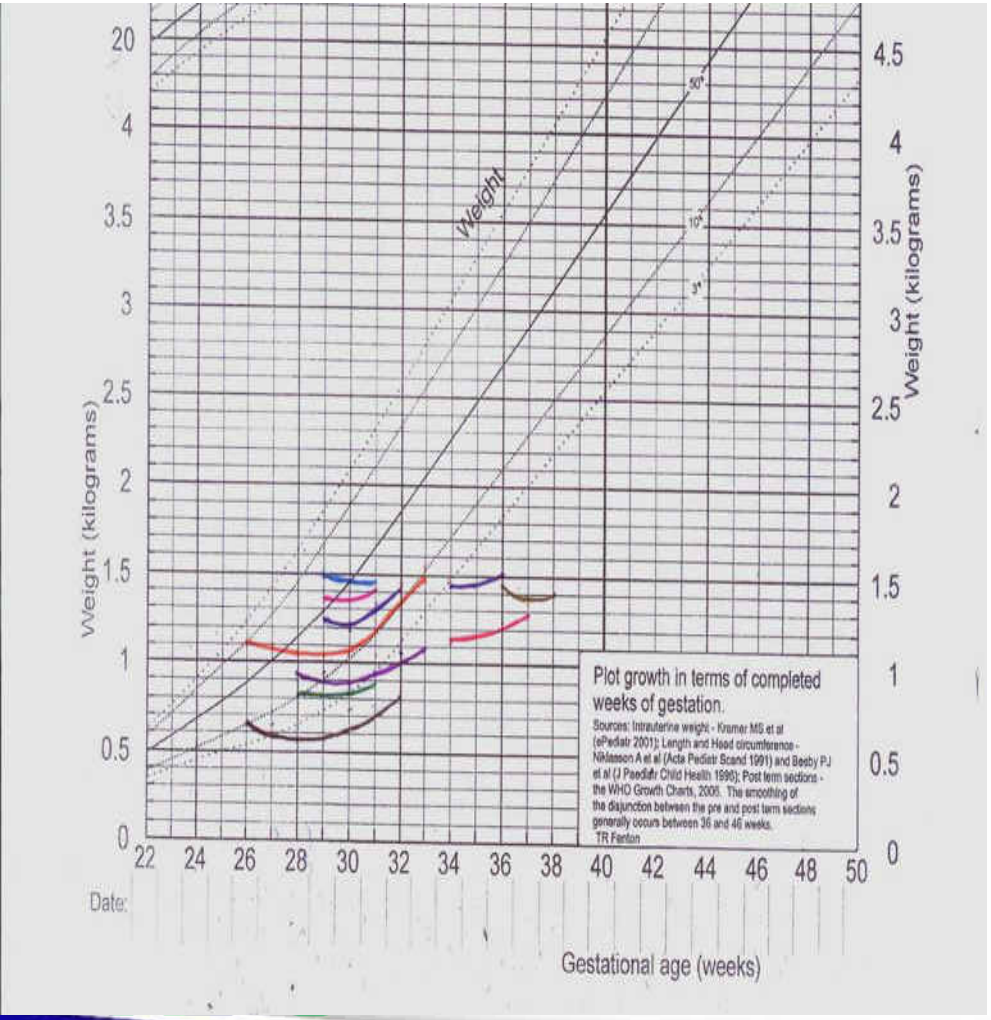
Tailor-made Nutrition

- Optimal fortification of human milk
- Growth and metabolic monitoring (Proteins, Hb, Ferritin, Ca PO4,alk PO4)

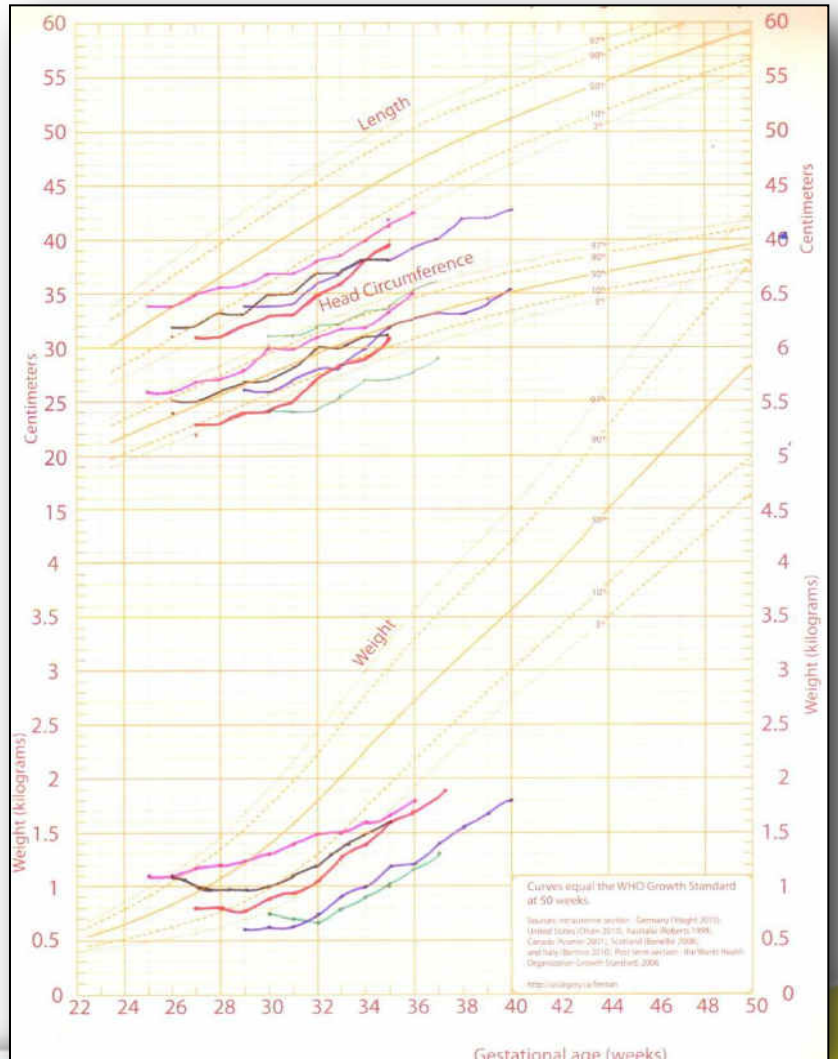


Growth of KEM babies

2010

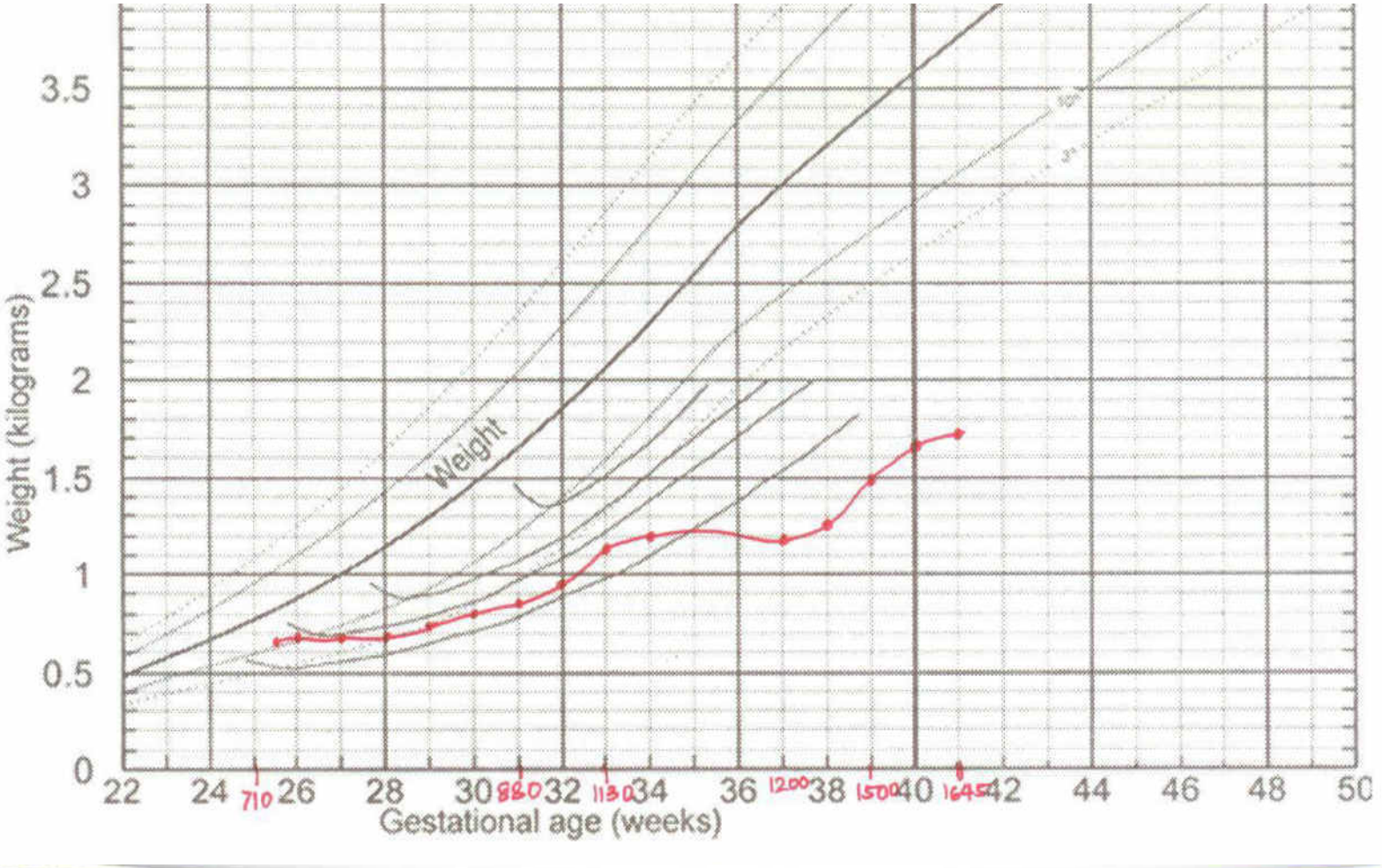


2015



POST-DISCHARGE NUTRITION

Baby K , GA 25 weeks Triplet, Weight 710 gms



What could be the reasons for poor growth ?

Inadequate feeding due to poor suck and swallow
Inadequate breast milk
Cold stress
Exaggerated anaemia of prematurity
Inadequate calorie / protein intake due to discontinuation of fortification
Sepsis/sickness in the baby
Electrolyte imbalance (Late onset Hyponatraemia)

3. Human milk fortification after Discharge

Powdered Human Milk Fortifier (HMF)

Proper training of mother important

Estimate approx milk intake and calculate dose of HMF

Express milk to mix HMF and then can breastfeed

2 gm in 50 ml EBM (1 gm HMF in 25 ml EBM)

Fortification with MCT oil – not recommended due to lack of scientific evidence *(Cochrane Review 2009)*

Special post – discharge formulae (72–80 kcal/dl)

4. Post-Discharge Nutritional Supplementation

Stable, full feeds

Multivitamin with Zinc (? Continue till 1 year)

Calcium : Phosphorus (continue till term / 3 kg)

Vitamin D 800 IU per day (ESPGHAN 2010)
(continue till 1 year)

4 -6 weeks

Start Iron supplementation

Continue till one year

Nutritional supplementation for preterms

- **Vitamin A** - 1500 IU per day

  (Dose of multivitamin drops to be titrated accordingly)

- **Zinc** 2.5 mg - 3 mg / d
- **Vitamin D:** 800-1000 IU /day *(ESPGHAN 2010)*
- **Calcium** 150 mg /kg
- **Phosphorus** 75 mg /kg

MULTIVITAMIN DROPS (per 1 ml)

	Brand A	Brand B	Brand C
A	2500 IU	1000 IU	2750 IU
D_3	200 IU	400 IU	250 IU
E	2.5 mg	1.5 mg	5 mg
C	40 mg	40 mg	40 mg
B_1	1 mg	2 mg	1 mg
B_6	---	1 mg	1 mg
K	---	---	---
DOSE:	**0.5 ml**	**1 ml**	**0.5 ml**

Iron supplementation

• < 1000g	4 mg / kg / d
• 1000-1500g	3-4 mg / kg / d
• 1500-1800g	2-3 mg / kg / d
• >1800g	2 mg / kg / d

- Start at 4-6 weeks, Continue till 12-15 months
- For babies <1500 gm early supplementation (2 weeks) may be considered

IRON DROPS (per ml)

	Brand T	Brand F	Brand R
Elemental iron	25 mg	20 mg	10 mg
B_{12}	12.5 ug	4 ug	NIL
Folic acid	200 ug	200 ug	100 ug
Lysine	200 mg	5 mg	NIL
mg Fe / drop	**1**	**1**	**0.3**

6. When to start complementary foods?

- **Complementary food should be started about at corrected age of 4-6 months for preterm infants**

Deborah L, Unger S. Seminars in fetal and neonatal medicine, (2013)

- **Generally, most babies would be around 5 kg, would have some neck support and tongue-thrust reflex would have diminished**

- **Complementary foods are chosen as per recommendation for term infants**

SUMMARY

- Postnatal growth retardation common in preterm LBWs
- Optimal growth targets unclear , but prevention of EUGR is mandatory
- Current trends favour aggressive nutrition strategies to improve neurologic outcome
- Early PN, use of human milk, fortification of enteral feeds to achieve adequate calories and proteins

SUMMARY (Contd)

Human Milk Banking now a national mission

Donor Human milk has both short and long-term benefits

Protein deficits are contributing to growth failure

Recent guidelines suggest higher protein intakes for for babies < 1500 g

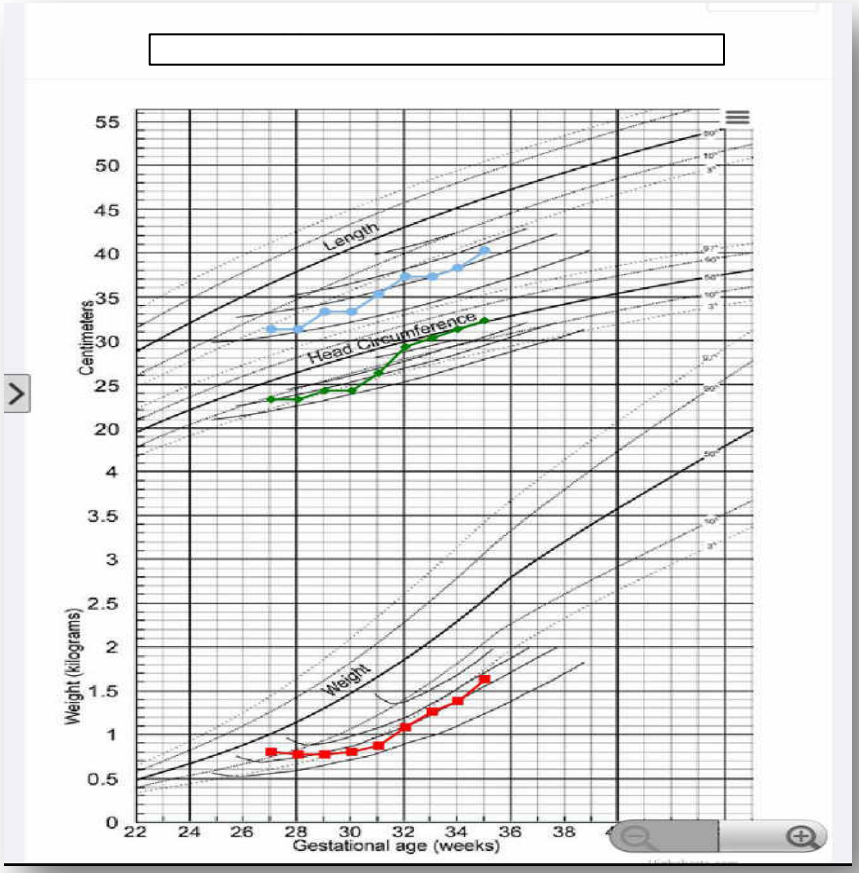
Novel methods for protein fortification are being studied

SUMMARY (Contd)

Essential to drive and achieve optimal growth amongst all odds

Bedside management tool facilitates better nutrition by providing the interface between nutrition delivery and growth outcome

LET US PROVIDE THE BEST NUTRITION !!!



OPTIMAL GROWTH IS

TOMORROW'S OUTCOME!