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Ministry of Health

Directorate General of Khoula Hospital

Department of Neonate Intensive Care Unit

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Document Title: Enteral Feeding Protocol for Preterm

Approval Process

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Contents Table:

Acronyms:

HC	Head circumference
EBM	Expressed breast milk
IUGR	Intra uterine growth retardation
ml q6h	Milliliter every 6 hours
Post-NEC	Post necrotizing enterocolitis
BUN	Blood urea nitrogen

Enteral Feeding Protocol for Preterm

1. Introduction

Vigorous nutritional support is needed to correct growth restriction at birth and achieve appropriate rates of weight gain, which are almost twice that of a term infant.

2. Scope

This protocol applies to all pediatricians and nurses working in Neonatal Intensive Care Unit (NICU) in Khoula Hospital.

3. Purpose

The purpose of this protocol is to standardize the nutrition practice for babies born prematurely.

4. Definitions:

4.1. Enteral feeding means: nutrition taken through gastrointestinal tract.

4.2. Total parenteral nutrition means: feeding that bypass the gastrointestinal tract, fluids are given into vein to provide most of nutrients the body needs.

4.3. Milk fortifiers means: a dietary supplement added to mother's milk to increase its caloric, mineral, protein and vitamin content

5. Protocol

The nutritional goal for premature neonate is to achieve rate of growth and nutrient accretion that match those achieved by fetus of similar gestational age in-utero, while avoiding complications that can be caused by nutritional therapies. This goal remains challenging, however standardization of nutritional practice will help to reduce extra uterine growth retardation.

5.1. Energy requirement:

5.1.1. The average daily requirement of enteral feed for preterm neonate is 120 ml/kg/day.

5.1.2. For infants with chronic illness, such as bronchopulmonary dysplasia energy needs can reach up to 150 kcal/kg/day because of increased resting energy expenditure, activity and possibly fecal losses.

5.2 . Nutrient requirement:

5.2.1. The appropriate enteral intake for a particular nutrient can be estimated from established rates of intrauterine accretion, plus estimation of daily losses, divided by the bioavailability (net absorption) of the nutrient.

5.2.2. Clinical condition will affect absorption for example, absorption of calcium and phosphorus is affected by postnatal age and intake of lactose, fat, vitamin D. So clinical condition should be taken into consideration when prescribing the nutrients.

5.3. Nutritional monitoring:

5.3.1. Nutritional assessment of the preterm neonate requires determination of the daily energy and nutrient requirement for optimal growth. The nutrient targets are then readjusted if the target growth is not met.

5.3.2. Rate of growth:

A. Adequate growth is monitored by serial measurements of weight, length and head circumference.

B. Weight is assessed daily, targeting increment of 15-20 gram/kg/day.

C. Length is assessed weekly, targeting an average increment 1 cm per week.

D. Head circumference is assessed weekly targeting an increment from 0.5-1 cm per week

E. Growth parameters should be plotted on growth chart curves appropriate for gestational age. (**Appendix 1**)

5.4. Laboratory monitoring:

Laboratory investigations should be done every two weeks after full feed is achieved which include:

A. Bone mineral status : calcium, phosphorus, alkaline phosphatase

B. Hemoglobin: is monitored to assess for anemia which may reflect rate of growth.
C. Electrolytes: including sodium, potassium should be evaluated especially in infants who receive diuretics, fed unfortified human milk, intake are limited or have slow growth.
D. Zinc: should be measured in infants with unusual intestinal losses such as those with enterostomies or short bowel syndrome

The pattern of changes in biochemical indices reflect of nutritional status than isolated value. For Normal laboratory values see **table (1)**

5.5. Tube feeding:

5.5.1. Infants weighing < 1500 grams (usually less than 32 weeks) require tube feeding because they are not able to suck and /or coordinate sucking swallowing and breathing.

5.6. **Oral feeding**:

5.6.1. Oral feed should be initiated when infant demonstrate readiness, when the infants between 32-34 weeks of gestation. So sucking reflex should be assessed before starting oral feed.

5.6.2. Swab the oropharynx with 0.2 ml of expressed colostrum about every 3 h from d1

5.6.3. Continue oropharyngeal swab with mother's milk until infant is taking feed orally.

5.6.4. Trophic feed must be started by oropharyngeal tube at 10-20 ml/kg/day.

5.7. Type of milk and infant feeding process:

Breast milk is best for all infants. Evidence suggests that the use of breast milk in preterm and small for gestational age neonate provides protection from infection particularly necrotizing enterocolitis.

5.8. **Rate of volume increase:** advance the feed at rate depends on maturity and feeding tolerance of the infant. **See table 2**.

5.8.1. Feeding for infants 1750-2000 kg

Day1 of feed start 2mlq3h then progress 2ml q6h till reach full feed

5.8.2. feeding for infants 1500-1749 grams

Day 1 of feed start 1ml q2h then progress 1ml q6h till reach full feed

5.8.3. Feeding for infants 1250-1499 grams

Day1 of feed start 1 ml q 2h then progress 1 ml q8h till reach full feed

5.8.4. feeding for infants 1000-1249 grams

A. Day 1 of feed start 1 m1 q 4h

B. Day 2 1ml q2h

C. Day 3 progress feed 1ml q8 h till reach full feed

5.8.5. Feeding for infants 750-999 grams

A. Day 1of feed start 1 ml q4h

B. Day 2 of feed 1ml q2h

C. Day 3 of feed progress 1m q12h till reach full feed

5.8.6. Feeding for infants<750 grams

A. Day 1of feed start 1ml q4h

B. Day 2 of feed 1ml q2h

C. Day 3 of feed 1ml q 1h

D. Day 4 of feed 1.5ml q1h

E. D5ay 5 of feed progress 0.5 ml q12 h till reach full feed

5.9. As enteral feed advanced, the parenteral nutrition is gradually decreased.

5.9.1. Lipids should be stopped when infant reached 50 % of total energy as feed.

5.9.2. Parenteral nutrition might be discontinued when enteral feed reach 100 ml/kg/day.

5.10. Fortifiers can be added to human milk when feed reach 100ml/kg/day for babies weighing > 1kg, and when feed reached 120ml/kg/day for babies weighing < 1 kg.

5.11. Vitamin D might be added when feed reach 50% from total intake, multivitamin when reach full feed and iron might be started on day 14.

5.12. Enriched diet: for preterm neonate whose weight remain below the 10th centile for age with fortified milk and unable to consume 180 ml/kg/day due to fluid restriction, enrich the mother's Milk with high caloric Powder formula.

5.13. For babies with Severe IUGR, Perinatal depression, Post-NEC, Post sepsis, or no EBM might choose slower increment rate (1 weight category lower).

5.14. Tailor progression of feeding according to clinical assessment of feeding tolerance.

5.15. Clinical assessment for feed intolerance:

5.15.1. Use the following clinical symptoms and signs to determine feeding intolerance:

A. Vomiting

B. Abdominal examination: distension or tenderness /increased or absent bowel sound

C. Gastric residual fluids: increase in the volume of residue or change in the color to green or blood

D. Stool output: any change in the frequency of stool output or presence of blood

E. Others: increase episodes of apnea and bradycardia may be related to feeding intolerance.

5.15.2. In infants with feeding intolerance as large residual volume check the following:

A. Feeding tube position

B. Feeding tube caliber (small caliber prevent swallowed air to be evacuated) and this swallowed air cause over distension displace milk causing feeding intolerance.

C. Baby position: some babies are improved by their being in prone or in right lateral decubitus compared to supine position.

6. Responsibilities

6.1. Head of pediatrics shall:

6.1.1. Ensure that all doctors and nursing staff are implementing of this policy.

6.1.2. Ensure that this guideline is updated as per guideline of khoula hospital

6.2.Pediatricians shall:

6.2.1. To follow feeding protocol according the baby weight.

6.2.2. Nutritional assessment (weight/HC/length) and to be plotted on growth chart.

6.2.3. Explain to the mother the importance of expressing EBM

6.2.4. Assessment of any signs of feeding intolerance.

6.3.The nursing staff

6.3.1. Follow the feeding protocol according to the weight

6.3.2. Ensure proper insertion and position of the feeding tube

6.3.3. Help the mother in expressing milk and educate them about importance of breast feeding

6.3.4. Early detection of early signs of feeding intolerance and to inform pediatrician.

7. Document History and Version Control

Document History and Version Control			
Version	**Description of Amendment**	**Author**	**Review Date**
01	Initial Release		
02			
03			
04			
05			

Written by	Reviewed by	Approved by

8. References:

Title of book/ journal/ articles/ Website	Author	Year of publication	Page
Nutritional needs of the preterm infant. In: Pedi atric Nutrition, 7th ed,),	Kleinman RE, Greer FR	2014.	p.83
American Academy of Pediatrics Committee on Nutrition. Pediatric nutrition, 7th ed, ,	Kleinman RE (Ed)	2013	
Nutritional requirements of the premature infan t. In: Textbook of Pediatric Nutrition,	Ziegler EE, Biga RL, Fomon SJ	New York 1981.	p.29
Normative early head growth in very-low-birth-weight infants.	Gross SJ, Eckerman CO	1983	103:946.
Buccal administration of human colostrum: impact on the oral microbiota of premature infants. l	Sohn K, Kalanetra KM, Mills DA, Underwood MA	2016	36:106.
Early versus Delayed Human Milk Fortification in Very Low Birth Weight Infants-A Randomized Controlled Trial.	Shah SD, Dereddy N, Jones TL, et al	2016	174:126
Minimal enteral feeding reduces the risk of sepsis in feed-intolerant very low birth weight newborns.	Terrin G, Passariello A, Canani RB, et al.	2009	98:31

Appendix 1

GROWTH CHARTS

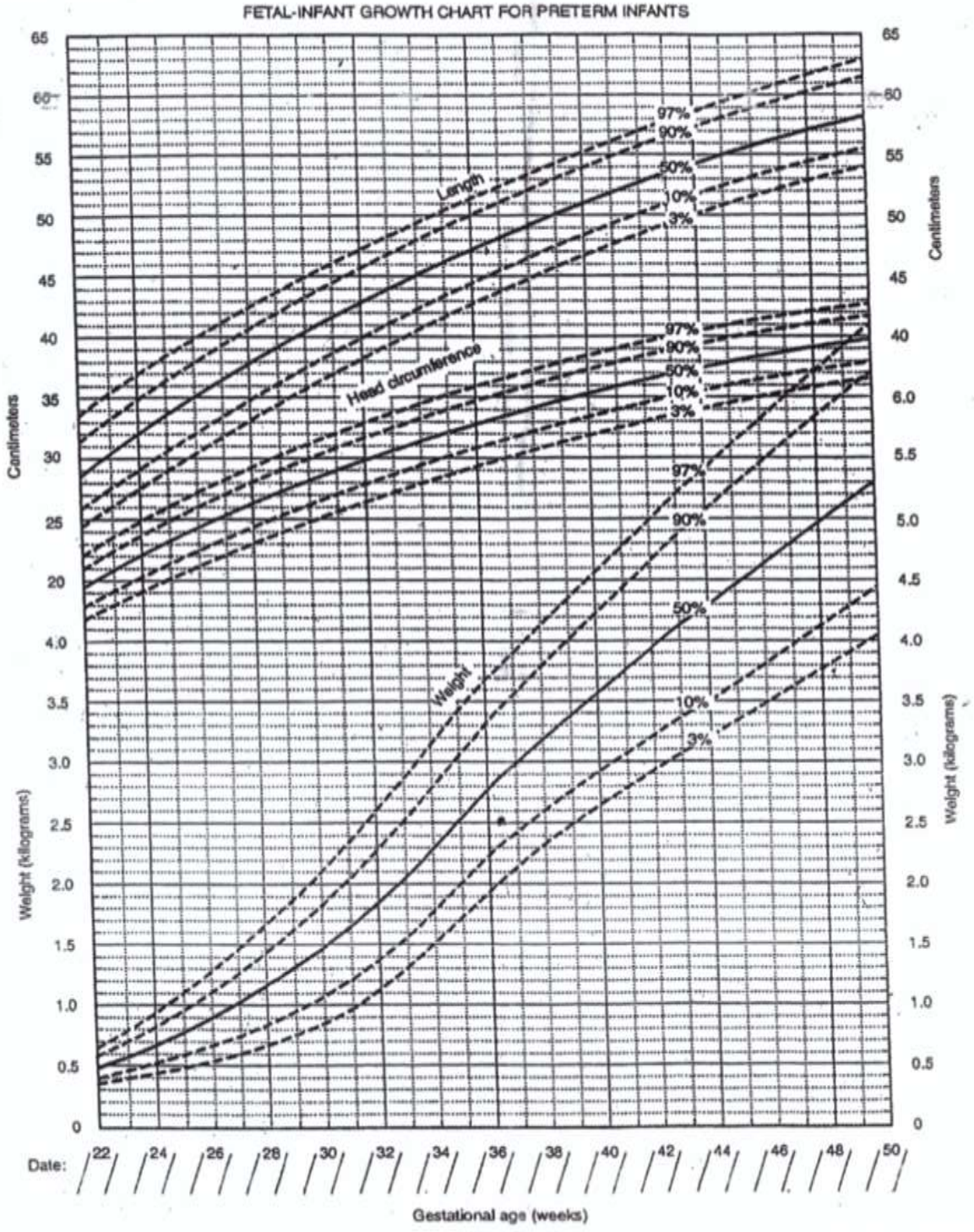

Figure B–4. Fetal-infant growth chart developed through a meta-analysis of published reference studies. (*From Fenton TR: A new growth chart for preterm babies: Babson and Benda's chart updated with recent data and a new format*, BMC Pediatr 3:13, 2003.)

Table 1

VALUE	DAY 1	DAY 3	DAY 7	DAY 21	DAY 35	DAY 49
Na (mEq/L)	140 (133-146)	140 (133-146)	140 (133-146)	136 (129-142)	137 (133-148)	137 (133-142)
K (mEq/L)	5.6 (4.6-6.7)	5.6 (4.6-6.7)	5.6 (4.6-6.7)	5.8 (4.5-7.1)	5.5 (4.5-6.6)	5.7 (4.6-7.1)
Cl (mEq/L)	108 (100-117)	108 (100-117)	108 (100-117)	108 (102-116)	107 (100-115)	107 (101-115)
Ca (millimol/L)	2.3 (1.5-2.9)	2.3 (1.5-2.9)	2.3 (1.5-2.9)	2.4 (2.0-2.8)	2.4 (2.2-2.6)	2.4 (2.2-2.7)
Ca (I) (millimol/L)	0.81-1.41	0.72-1.44	1.04-1.52 (d5)	1.04-1.52	1.04-1.52	1.04-1.52
PO4 (millimol/L)	2.5 (1.7-3.5)	2.5 (1.7-3.5)	2.5 (1.7-3.5)	2.4 (2.0-2.8)	2.3 (1.8-2.6)	2.2 (1.4-2.7)
Mg (millimol/L)	0.62-1.02	0.66-1.10	0.75-1.00	0.75-1.00	0.75-1.00	0.75-1.00
Urea (millimol/L)	3.3 (1.1-9.1)	3.3 (1.1-9.1)	3.3 (1.1-9.1)	4.8 (0.8-11.2)	4.8 (0.7-9.5)	4.8 (0.9-10.9)

Table_2

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Feeding Schedule for Infants With Birth Weight <750g

Feed / Time / *Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1				1				1				1				1				1			
2	1		1		1		1		1		1		1		1		1		1		1		1	
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
5	2	2	2	2	2	2	2	2	2	2	2	2	**2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
6	3	3	3	3	3	3	3	3	3	3	3	3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
7	***4	4	4	4	4	4	4	4	4	4	4	4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
8	5	5	5	5	5	5	5	5	5	5	5	5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5

*Days of feeds **not** days of life

**Consider adding Vit D
***Consider adding HMF, followed by MVT drops

Sticker

Feeding Schedule for Infants With Birth Weight 750-999g

Feed / Time / *Days	1	2	3	4	5	6	7	8	9	10	11	12
1	1		1		1		1		1		1	
2	1	1	1	1	1	1	1	1	1	1	1	1
3	2	2	2	2	2	2	3	3	3	3	3	3
4	4	4	4	4	4	4	5	5	5	5	5	5
5	**6	6	6	6	6	6	7	7	7	7	7	7
6	8	8	8	8	8	8	9	9	9	9	9	9
7	***10	10	10	10	10	10	11	11	11	11	11	11
8	12	12	12	12	12	12	13	13	13	13	13	13
9	14	14	14	14	14	14	15	15	15	15	15	15

*Days of feeds **not** days of life

**Consider adding Vit D
***Consider adding HMF, followed by MVT drops

Sticker

Feeding Schedule for Infants With Birth Weight 1000-1249g

Feed / Time / *Days	1	2	3	4	5	6	7	8	9	10	11	12
1	1		1		1		1		1		1	
2	1	1	1	1	2	2	2	2	3	3	3	3
3	4	4	4	4	5	5	5	5	**6	6	6	6
4	7	7	7	7	8	8	8	8	9	9	9	9
5	***10	10	10	10	11	11	11	11	12	12	12	12
6	13	13	13	13	14	14	14	14	15	15	15	15

*Days of feeds **not** days of life

**Consider adding Vit D
***Consider adding HMF, followed by MVT drops

Sticker

Feeding Schedule for Infants With Birth Weight 1250-1499g

Feed / Time / *Days	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	1	2	2	2	2	3	3	3	3
2	4	4	4	4	5	5	5	5	6	6	6	6
3	7	7	7	7	**8	8	8	8	9	9	9	9
4	10	10	10	10	***11	11	11	11	12	12	12	12
5	13	13	13	13	14	14	14	14	15	15	15	15
6	16	16	16	16	17	17	17	17	18	18	18	18
7	19	19	19	19	20	20	20	20	21	21	21	21

*Days of feeds **not** days of life

**Consider adding Vit D
***Consider adding HMF, followed by MVT drops

Sticker

Feeding Schedule for Infants With Birth Weight 1500-1749g

Feed / Time / *Days	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	2	2	3	3	3	4	4	4
2	5	5	5	6	6	6	7	7	7	8	8	8
3	9	9	9	10	10	10	11	11	11	12	12	12
4	13	13	13	14	14	14	***15	15	15	16	16	16
5	17	17	17	18	18	18	19	19	19	20	20	20
6	21	21	21	22	22	22	23	23	23	24	24	24

*Days of feeds **not** days of life

**Consider adding HMF, followed by MVT drops

Sticker

Feeding Schedule for Infants With Birth Weight 1750-2000g

Feed / Time / *Days	1	2	3	4	5	6	7	8
1	2	2	4	4	6	6	8	8
2	10	10	12	12	14	14	16	16
3	18	18	20	20	22	22	24	24
4	**26	26	28	28	30	30	32	32
5	34	34	36	36	38	38	40	40

*Days of feeds **not** days of life

**Consider adding MVT drops