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Breastfeeding for Sick and Preterm Babies

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General benefits of breastfeeding

Benefits to the mother	Benefits to the baby
Decreased risk of postpartum haemorrhage	Optimal nutrition for the majority of infants
Promotes mother-infant bonding	Immunological benefits
Decreased risk of diseases, e.g., breast and ovarian cancer, type 2 diabetes, hypertension	Decreased risk of diseases, e.g., asthma, obesity, type 1 diabetes, pneumonia, otitis media, SIDS, NEC

Accessed on 18 Nov 2024 from: https://www.cdc.gov/nutrition/infantandtoddlernutrition/breastfeeding/recommendations-benefits.html

Human milk:

- Nutrients
  - Proteins
  - Carbohydrates
  - Lipids
  - Vitamins
  - Minerals
- Immune factors
  - Immunoglobulins
  - Immune cells
  - Beneficial micro-organisms
- Hormonal factors
  - Growth factors
  - Leptin
  - Thyroid hormones
- Others
  - Human milk oligosaccharides
  - Enzymes

Formula milk:

- Nutrients
  - Proteins
  - Carbohydrates
  - Lipids
  - Vitamins
  - Minerals
- Immune factors
  - Some probiotics/ prebiotics
- Others
  - Some oligosaccharides

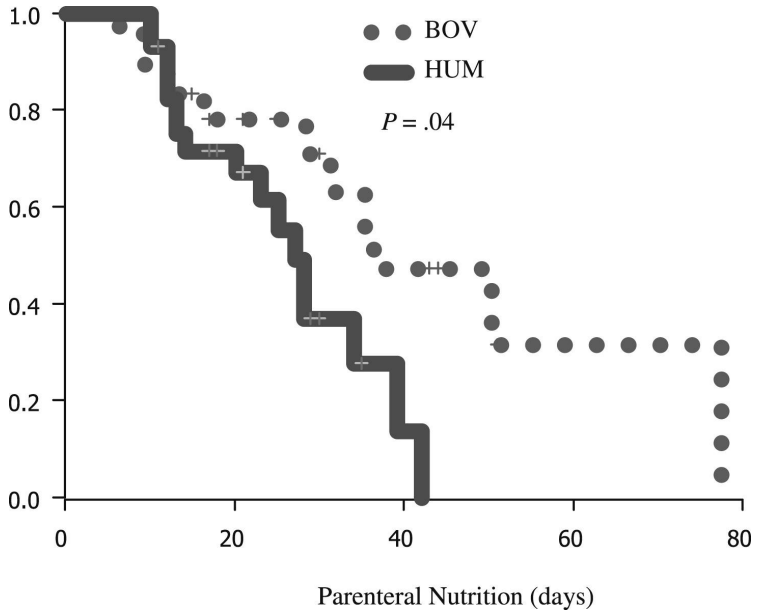
Complications of prematurity

- Preterm infants are at increased risk of complications such as necrotising enterocolitis (NEC), late-onset sepsis (LOS) and bronchopulmonary dysplasia (BPD)
- Consequences of complications of prematurity:
  - Prolonged ventilatory support
  - Prolonged hospitalisation
  - Increased risk of long-term morbidities such as neurodevelopmental impairment
- Additional risks for NEC:
  - Prolonged nutritional support
  - Short bowel syndrome, malabsorption, failure to thrive
  - Neurocognitive impairment (Lapidaire et al 2021)

Benefits of human milk in preterm infants

Preterm infants with birth weights of 500-1250 g

	Formula milk	Human milk	P-value
Parenteral nutrition, d	36 (28, 77)	27 (14, 39)	**0.04**
Late-onset sepsis, n	19 (79%)	16 (55%)	>0.05
NEC, n	5 (21%)	1 (3%)	0.08
NEC surgery, n	4 (17%)	0	**0.036**
NEC and/or death, n	5 (21%)	1 (3%)	0.08
Mechanical ventilation, d	24 (10, 75)	17 (2, 38)	>0.05
Oxygen therapy, d	28 (21, 61)	20 (5, 32)	>0.05
ROP, n	5 (21%)	8 (28%)	>0.05
Death, n	2 (8%)	0	>0.05



Accessed from: Cristofalo et al. J Pediatr. 2013;163:1592-1595.e1.

Benefits of human milk in preterm infants

- In 243 preterm infants < 30 weeks gestation:
  - 70 received only MOM
  - 81 received donor breast milk
  - 92 received formula milk
- No difference between three groups:
  - Birth weight
  - Gestational age
- Infants receiving MOM had fewer episodes of LOS and/or NEC and had shorter duration of hospitalisation
- Infants receiving donor breast milk did not have fewer episodes of LOS and/or NEC compared with infants receiving formula milk, but had slower weight gain

Schanler et al. Pediatrics. 2005;116:400-6.

Benefits of human milk in preterm infants:

In a retrospective cohort study of 964 preterm infants < 35 weeks gestation and birth weight < 1500 g, dose-dependent benefits of human milk (>/= 50 mL/kg/day) were seen compared with exclusive artificial formula (Xu et al 2020)

- Bronchopulmonary dysplasia (BPD) risk 0.453 (0.309, 0.666)
- Moderate to severe BPD risk 0.430 (0.249, 0.742)
- NEC risk 0.13 (0.162, 0.607)
- LOS risk 0.42 (0.263, 0.673)
- Growth retardation risk 0.685 (0.479, 0.979)

Table 3 Logistic regression analyses examining protective effect on neonatal morbidity of various doses of human milk versus no human milk in first 4 weeks of life

Neonatal morbidity	Daily volume of human milk (ml/kg)	Univariate	*P*-value	Multivariate	*P*-value
BPD[a]	0	OR = 1		OR = 1	
	1–24	1.020 (0.666, 1.563)	0.927	0.811 (0.496, 1.325)	0.403
	25–49	0.786 (0.515, 1.201)	0.267	0.746 (0.459, 1.213)	0.237
	≥50	0.566 (0.410, 0.781)	0.001	0.453 (0.309, 0.666)	0.000
Moderate-severe BPD[a]	0	OR = 1		OR = 1	
	1–24	0.690 (0.369, 1.291)	0.246	0.501 (0.246,1.013)	0.054
	25–49	0.537 (0.279, 1.032)	0.062	0.549 (0.267,1.129)	0.103
	≥50	0.505 (0.317, 0.803)	0.004	0.430 (0.249,0.742)	0.002
NEC[b]	0	OR = 1		OR = 1	
	1–24	1.358 (0.726, 2.540)	0.338	1.208 (0.626,2.331)	0.574
	25–49	1.561 (0.863, 2.822)	0.141	1.631 (0.870,3.059)	0.127
	≥50	0.330 (0.176, 0.618)	0.001	0.314 (0.162,0.607)	0.001
NEC(≥Bell's stage 2)[b]	0	OR = 1		OR = 1	
	1–24	2.208 (0.440, 11.093)	0.336	1.244 (0.198, 7.823)	0.816
	25–49	2.029 (0.404, 10.188)	0.390	2.037 (0.387, 10.714)	0.401
	≥50	1.114 (0.264, 4.698)	0.883	0.854 (0.193, 3.786)	0.836
Later onset sepsis[b]	0	OR = 1		OR = 1	
	1–24	1.473 (0.902, 2.406)	0.122	1.413 (0.851, 2.346)	0.182
	25–49	0.982 (0.588, 1.641)	0.944	1.038 (0.607, 1.774)	0.892
	≥50	0.419 (0.269, 0.652)	0.000	0.420 (0.263, 0.673)	0.000
EUGR[a]	0	OR = 1		OR = 1	
	1–24	0.877 (0.575, 1.339)	0.544	1.287 (0.803,2.062)	0.294
	25–49	0.575 (0.380, 0.868)	0.009	0.701 (0.434,1.132)	0.147
	≥50	0.461 (0.338, 0.629)	0.000	0.685 (0.479,0.979)	0.038

BPD Bronchopulmonary dysplasia; *CI* confidence interval; *EUGR* extrauterine growth retardation; *NEC* necrotizing enterocolitis; *OR* odds ratio
[a]Adjusted for gestational age, small for gestational age, multiple births, cesarean section, 5'Apgar score < 7, neonatal critical score, Score for Neonatal Acute Physiology II; mechanical ventilation time ≥ 7 days
[b]Adjusted for gestational age, small for gestational age, multiple births, cesarean section, 5'Apgar score ≤ 7; Score for Neonatal Acute Physiology II, neonatal critical score

Accessed from: Xu et al. BMC Pediatr. 2020;20:522.

Opportunities for improvement

- NEC rates in Hong Kong have been high compared with Australian & New Zealand Neonatal Network (ANZNN) rates:
  - NEC rates in infants <30 weeks gestation (2018):
    - HK: 16.3%
    - ANZNN: 8.4% (<28 weeks gestation)
  - NEC rates in infants <30 weeks gestation (2019):
    - HK: 14.0%
    - ANZNN: 6% (<28 weeks gestation)
- Increasing use of human milk in preterm infants may help improve NEC rates in HK NICUs

Supporting breastfeeding in NICUs

- Breastfeeding education
- Lactation support
- Use of donor milk when necessary
- Encouraging kangaroo care

Use of donor breast milk

- The Hong Kong Breast Milk Bank (HKBMB) announced in the 2023 Policy Address will likely commence operations in 2025
- HKBMB will prioritise supply of donor milk as follows:
  - Very/extremely preterm infants <32 weeks or very/extremely low birth weight infants <1,500 g
  - Infants with medical or surgical conditions:
    - severe/complex congenital cardiac conditions
    - severe medical/surgical conditions, especially related to the gastrointestinal tract
    - history of severe hypoxic-ischaemic insult
  - Preterm or low birth weight infants without diseases
  - Full-term infants without diseases
- For preterm infants who reach 34-36 weeks postconceptional age and/or 4-8 weeks postnatal age, the NICU team may consider lowering their priority relative to other less mature infants within their category

Benefits of pasteurised breast milk in NEC

- Benefits of human milk vs formula milk include:
  - Decreased incidence of NEC in preterm infants with donor milk
    - Risk of NEC increases, relative risk 1.87 (1.23 to 2.85) with artificial formula compared with donor milk when mother's own milk is not available (Quigley et al 2019)
    - Mean decrease of NEC rate in 22 Californian hospitals by 2.6% (-3.9% to -1.3%) (Kantorowska et al 2016) after increased availability of donor milk
- However, it must still be noted that mother's own milk has benefits over donor milk, including improved gut microbiome, improved feeding tolerance (Ford et al 2019), NEC rates (Sanchez et al 2021)

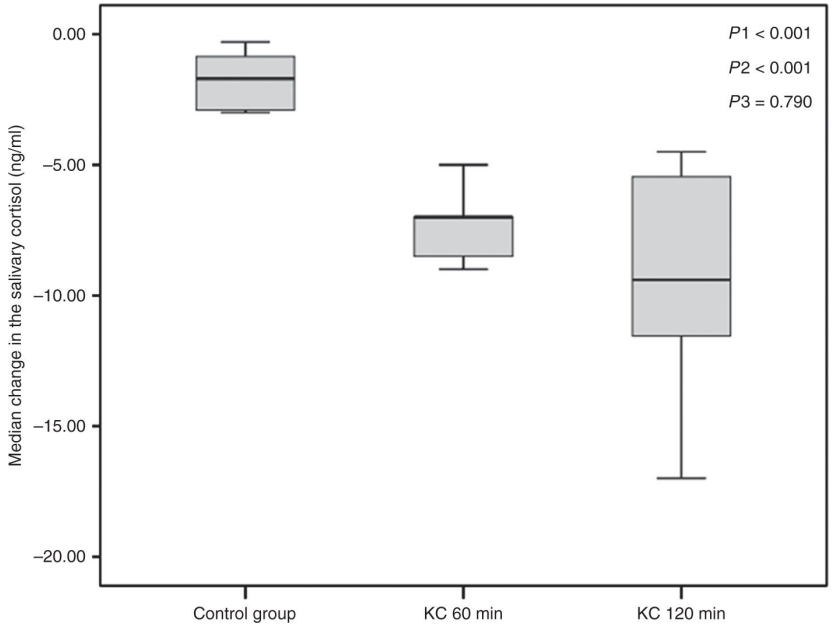
Pasteurised donor milk vs mother's own milk

- Most benefits to preterm infants demonstrated in studies have been for mother's own milk (MOM)
- Benefits of pasteurised donor milk are less well studied and have some theoretical disadvantages, e.g.,
  - Pasteurisation removes some of the nutritional and immunological benefits
  - Donor milk will be mature milk, which is lower in immunologically active components
- Donor milk should be used to bridge preterm infants to MOM where possible

Colostrum <2-5 days | Transitional milk 2-5 days to 2 weeks | Mature milk > 2 weeks

Kangaroo care for moderate preterms

- In a randomised controlled trial by El-Farrash et al, compared with standard care, infants (31-35 weeks gestation) randomised to kangaroo care groups:
  - achieve full enteral feeds faster
  - have improved:
    - breastfeeding success
    - neurobehavioral performance
    - thermal control
    - tissue oxygenation
    - salivary cortisol levels



Accessed from: El-Farrash et al. Pediatr Res. 2020;87:683-688.

Kangaroo care for extreme preterms

- In extremely preterm infants (<28 weeks gestation) who required non-invasive ventilation, kangaroo care significantly reduced time required to achieve full enteral feeding and improved rate of exclusive breastmilk feeding

Table 4 KMC regression analysis of EPI feeding-related outcomes

	Model I			Model II		
	β/OR	95%CI	*P*	β/OR	95%CI	*P*
Nosocomial Infection	1.54	(0.25, 9.53)	0.64	1.57	(0.24, 10.10)	0.64
Hospitalization expenses	-23747.81	(-49703.01, 2207.39)	0.07	-31492.80	(-50112.72, -12872.88)	0.001
Time to full enteral feeding	-5.35	(-8.09, -2.63)	0.0002	-6.01	(-8.59, -3.42)	< 0.0001
Time to full oral feeding	-0.74	(-5.88, 4.41)	0.78	-1.24	(-6.21, 3.74)	0.63
Exclusive breastmilk feeding for 24 h prior to discharge	2.43	(1.24, 4.78)	0.01	2.40	(1.21, 4.78)	0.01

Model I: adjusted for gestational age and admission weight

Model II: adjusted for gender, gestational age, birth weight, birth age, cesarean section, sufficient prenatal steroids, and IVF

Li et al. Int Breastfeed J. 2024;19:52.

Conclusion

- There are many benefits of breastmilk vs formula milk for preterm infants, e.g.,
  - Reduction in complications of prematurity such as NEC
- Potential ways to enhance breastmilk use in NICUs include:
  - Use of pasteurised donor milk as a bridge to MOM
  - Implementing kangaroo care
- Beware of limitations of breastmilk for preterm infants and need for nutritional supplementation

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