Nutritional Intake of Preterm Infants – An Audit of practice at a Tertiary Neonatal Unit in Scotland

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Place of Audit: Princess Royal Maternity Hospital, Glasgow

Background:

Growth of preterm infants in neonatal intensive care unit is affected by nutritional and non-nutritional factors (like infection, critical illness, inflammation, etc), and is linked to brain development and predict long term outcomes. The relationship between optimal protein and energy intake during first week of life is associated with better neurodevelopmental outcomes at 18 months in extremely low birth weight infants (<1000g)[1].

We did a clinical audit on nutritional intake of preterm infants in first two weeks of life.

Aim:

- Measuring energy and protein intake during first two weeks of life and comparing with BAPM and ESPGHAN standards.
- Comparing "z score" for weight at birth and 36 weeks corrected gestation

Standard:

- **BAPM parenteral nutrition(PN) guidelines:**

	First 24 hrs	24- 72 Hrs (D3)	More than or equal to 72 hrs (D5)
Protein intake (Amino acids) g/kg/day	2-2.5 g/kg	2.7-3.5	2.7-4 g/kg
Non nitrogenous energy (including lipid) kcal/kg/day	40-60	60-85	85-100
Total energy intake (Kcal/Kg/day)	60-80	80-100	100-120

Ratio of non-nitrogen energy: protein = 18-25 Kcal/gram

- **ESPGHAN standard:**

Energy intake	**110-135 Kcal/kg/day**
Protein intake	
<1Kg	**4-4.5 g/kg/day**
1-1.8 Kg	**3.5-4 g/kg/day**

Inclusion Criteria:

Infants born <30 weeks gestation at Princess Royal Maternity Hospital, Glasgow between 1st January 2018 – 30th June 2019.
Exclusion Criteria:
Born elsewhere, transfer-out <1month age, died, had NEC/critical illness/major congenital/chromosomal abnormalities.

Out of 75 infants born at <30 weeks, 43 met inclusion criteria. A representative sample of **30** infants was taken (by stratified random sampling) for our study with 37% infants born at 23-26 weeks gestation and 63% born at 27-29 weeks.

Data Collection: from case notes and online patient databases.

PN Types:
Standard Aqueous PN with Protein of 2.6g/100 ml (and 10% Dextrose base) used in 29 babies. One infant also received Concentrated PN (Protein 3.5g/100 ml, 16.8% Dextrose base).
Lipid formulation types:
We used either 20% Intralipid or Vitlipid or SMOFlipid.
Milk:
Mother's or donor breast milk or fortified breast milk was used.

Table 1: Protein Intake (g/kg/day)

	Day 1	Day 3	Day 5
Median	1.73	2.51	2.55
Mean	1.83	2.67	2.72
Min	1.04	1.93	2.00
Max	3.68	3.95	3.77
Standard Deviation	0.47	0.58	0.48

Results:

There were 12 females and 18 males. There were 15 infants weighing <1 Kg and 15 weighing between 1-1.8Kg. All infants received PN on D1. Lipid infusion was started in 23 (76%) babies on day 1 and on all by D2.
The median protein intake was found to be lower than BAPM and ESPAGHAN standards on D1, D3 and D5 (Table 1). On detailed review of protein intake from D3-D14, infants met the BAPM standard on 55% of the days.
The total energy intake on D1 was low (Median 52.97). On D3 and D5, the median energy was 92.2 and 107.3 kcal/kg/day, thus meeting the BAPM standards. The median non-nitrogenous energy and ratio of non-nitrogenous energy to protein intake on D1, D3, D5 met the BAPM standards

The energy standard of ESPGHAN when studied from D3-D14, was not met on 38% of the days. The protein intake when studied from D3-14 in infants <1 kg group and 1-1.8 kg group, didn't meet the criteria on 99.5% and 94.5% days respectively.

Median z score difference of weight at birth and 36 weeks corrected was -0.77 in boys and -0.76 in girls.

Table 2: Non-Nitrogenous Energy Including lipids (Kcal/kg/day)

	Day 1	Day 3	Day 5
Median	47.03	81.42	96.05
Mean	46.09	78.62	93.65
Min	30.35	50.23	76.81
Max	64.24	102.22	117.51
Standard Deviation	7.40	13.16	10.16

Table 3: Total Energy Intake (Kcal/kg/day

	D1	D3	D5
Median	52.97	92.22	107.32
Mean	53.40	89.32	104.53
Min	37.55	60.60	85.71
Max	78.95	117.44	129.25
Standard Deviation	8.56	14.47	10.85

Table 4: Ratio of Non-Nitrogen energy: Protein intake (Kcal/gram)

	Day 1	Day 3	Day 5
Median	30.21	26.24	35.27
Mean	30.13	26.08	35.24
Min	19.38	16.45	23.96
Max	40.45	37.58	47.79
Standard Deviation	5.74	5.18	6.00

Conclusions and Recommendations:

Overall the results (See tables and graphs) showed suboptimal protein intake in the infants in our department. We recommend higher protein/concentrated PN preparation. PN and lipids should be started at the earliest after birth. Early feed introduction and use of fortifier and protein supplements once on full feeds should be considered. We are planning to do a re-audit in future after implementation of these recommendations.

Reference:
1. Stephens BE, Walden RV, Gargus RA, et al. First-week protein and energy intakes are associated with 18-month developmental outcomes in extremely low birth weight infants. *Pediatrics*. 2009;123(5):1337-1343. doi:10.1542/peds.2008-0211

Nutritional Intake of Preterm Infants – An Audit of practice at a Tertiary Neonatal Unit in Scotland (Graphs)

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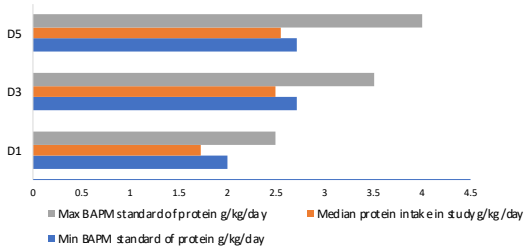
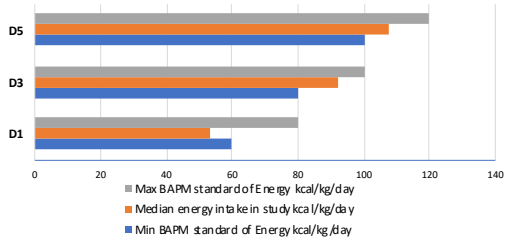
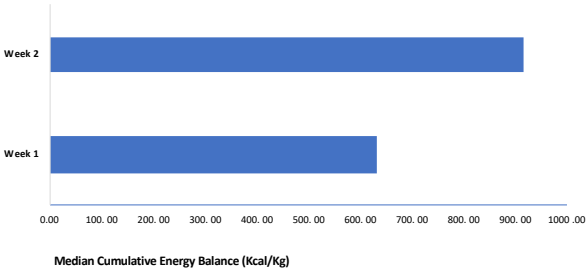
Graph 1: Total Protein Intake Intake g/kg/day: Comparison with BAPM Standard



Graph 2: Total Energy Intake kcal/kg/day - Comparison with BAPM Standard



Graph 3: Median Cumulative Energy Balance Kcal/kg



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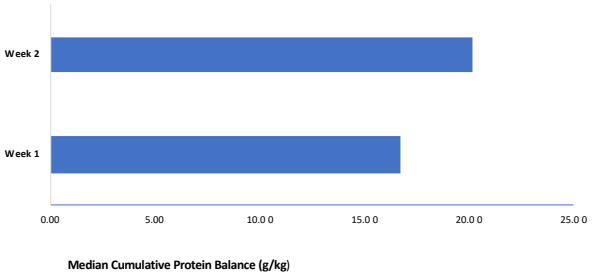
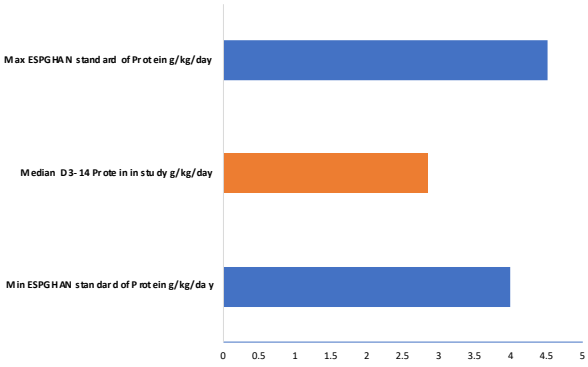
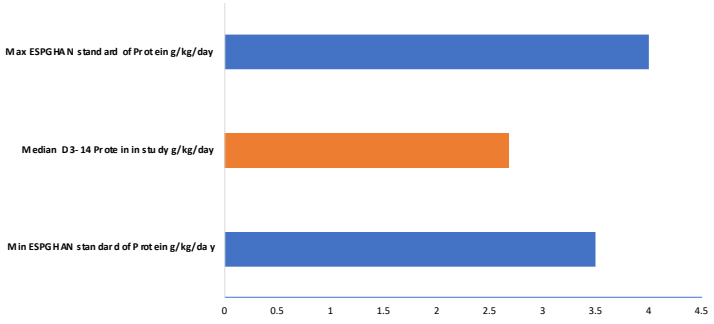


Graph 5: Protein intake in study compared with ESPGHAN Standard in infants with Birth Weight < 1 kg



Graph 6: Protein intake in study compared with ESPGHAN Standard in infants with Birth Weight 1-1.8 kg



Graph 7: Energy intake in study Day 3-14 compared with ESPGHAN Standard