Appropriate Dosing for Parenteral Nutrition: ASPEN Recommendations

Persistent shortages of parenteral nutrition (PN) components have led to a tendency of practitioners providing less than adequate dosing, which can lead to nutrient deficiencies and impair growth and healing. Clinicians who have entered practice within the last 10 years may have never cared for patients receiving PN therapy without a shortage of PN components. This document provides both the appropriate PN nutrient requirements and dosing recommendations for adult, neonatal, and pediatric patients. Please share with your colleagues.

Topline Recommendations

- **Do not ration nutrients for PN if the supply of those components is sufficient to provide the full daily dose.**
- **During component shortages, follow PN management recommendations available on the ASPEN website at nutritioncare.org/ProductShortageManagement/**
- **Return to appropriate dosing as soon as the component shortage has resolved.**
- **Rationing and conservation strategies are intended to be used only during shortages.**
- **The lack of observed adverse events/deficiencies and the potential cost savings associated with "partial" dosing should not be the impetus to continue less than optimal dosing.**

Note: These recommendations are general ranges and a patient's clinical condition and organ function should be taken into account. These recommendations do not constitute medical or other professional advice and should not be taken as such. To the extent that the information published herein may be used to assist in the care of patients, this is the result of the sole professional judgment of the attending healthcare professional whose judgment is the primary component of quality medical care. The information presented in here is not a substitute for the exercise of such judgment by the healthcare professional. Circumstances in clinical settings and patient indications may require actions different from those recommended in this document and in those cases, the judgment of the treating professional should prevail.

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TABLE 1. MACRONUTRIENTS

Disease/Clinical Condition	Protein/Amino Acids (g/kg/d)	Total Energy (kcal/kg/d)	PN	Component	Fluid (mL/kg/d)
			Dextrose (mg/kg/min)	ILE* (g/kg/d)	
Stable	0.8-1.5	20-30	4-5	1	30-40
Critically ill, trauma, sepsis	1.2-2.5	20-30	<4	<1	Minimal to provide adequate macronutrients
Different Amino Acid Requirements than Above	**Protein Amino Acids (g/kg/d)**	**Total Energy (kcal/kg/d)**			
Traumatic brain injury	1.5-2.5				
Burns	1.5-2				
Open abdomen	Additional 15-30 g/L exudate				
Acute kidney injury	0.8-2.0				
Continuous renal replacement therapy	Additional 0.2 g/kg/d not to exceed 2.5 g/kg/d)				
Chronic kidney failure with maintenance hemodialysis	1.2				
Hepatic failure	1.2-2 (based on "dry" weight and tolerance)				
Obese	2-2.5 (based on IBW)	22-25 (based on IBW)			

IBW = ideal body weight

**Soybean oil-based emulsion. For indications and dosing of other lipid injectable emulsions (ILE), see manufacturer's product literature.*

TABLE 2. ELECTROLYTE AND MINERAL

Nutrient	Standard Daily Requirement	Factors That Increase Needs
Calcium*	10-15 mEq	High protein intake
Magnesium	8-20 mEq	GI losses, medications, refeeding
Phosphorus*	20-40 mmol	High dextrose intake, refeeding
Sodium	1-2 mEq/kg*	Diarrhea, vomiting, NG suction, GI losses
Potassium	1-2 mEq/kg*	Diarrhea, vomiting, NG suction, GI losses, medications, refeeding
Acetate	As needed to maintain acid-base balance	Renal insufficiency, metabolic acidosis, GI losses of bicarbonate
Chloride	As needed to maintain acid-base balance	Metabolic alkalosis, volume depletion

**Use caution in prescribing calcium and phosphorus related to compatibility.*

GI = Gastrointestinal

TABLE 3. DAILY REQUIREMENTS FOR ADULT PARENTERAL VITAMINS*

Vitamin	Standard Daily Requirement
Thiamin (B_1)	6 mg
Riboflavin (B_2)	3.6 mg
Niacin (B_3)	40 mg
Folic acid	600 mcg
Pantothenic acid	15 mg
Pyridoxine (B_6)	6 mg
Cyanocobalamin (B_{12})	5 mcg
Biotin	60 mcg
Ascorbic acid	200 mg
Vitamin A	990 mcg
Vitamin D	5 mcg
Vitamin E	10 mg
Vitamin K	150 mcg

** Prescribe full daily dose unless patient able to ingest and/or absorb orally/enterally. Full dose of most multivitamin products available in the US provides the above requirements.*

TABLE 4. DAILY REQUIREMENTS FOR ADULT PARENTERAL TRACE ELEMENTS*

Trace Element	Standard Daily Requirement
Chromium	<1 mg
Copper	0.3-0.5 mg
Manganese	55 mcg
Selenium	60-100 mcg
Zinc	3-5 mg

** Prescribe full daily dose unless patient able to ingest or absorb orally/enterally.*

Note: These requirements are different than the multi-trace element products currently available in the US.

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TABLE 5. DOSING FOR INITIATION AND ADVANCEMENT OF PN MACRONUTRIENTS

	Initiation		Advance By		Goals	
Infants (<1 y)	**Preterm**	**Term**	**Preterm**	**Term**	**Preterm**	**Term**
Protein (g/kg/d)*	1-3 (3–4 max)	2.5–3	—	—	3–4	2.5–3
Dextrose (mg/kg/min)	6–8	6–8	1–2	1–2	10–14 (max 14–18)	10–14 (max 14–18)
ILE (g/kg/d)**	0.5–1	0.5–1	0.5–1	0.5–1	3 (max 0.15 g/kg/h)	2.5–3 (max 0.15 g/kg/h)
Children (1–10 y)						
Protein (g/kg/d)	1.5–2.5		—		1.5–2.5	
Dextrose (mg/kg/min)	3–6		1–2		8–10	
ILE (g/kg/d)**	1–2		0.5–1		2–2.5	
Adolescents						
Protein (g/kg/d)	0.8–2		—		0.8–2	
Dextrose (mg/kg/min)	2.5–3		1–2		5–6	
ILE (g/kg/d)**	1		1		1–2	

**Protein does not need to be titrated; protein needs are increased with critical illness.*

*** ILE dosing based on soybean oil-based emulsion. See manufacturer's product information for dosing of other ILE products.*

ILE= Lipid injectable emulsion

GIR = glucose infusion rate; GIR calculation (mg/kg/m) = [dextrose (g/d) x 1000] / [24 (h/d) x 60 (m/hr) x weight (kg)]

TABLE 6. PN ELECTROLYTE AND MINERAL DAILY DOSING*

	Preterm Neonates	Infants/Children	Adolescents & Children Greater than 50 kg
Sodium	2-5 mEq/kg	2-5 mEq/kg	1-2 mEq/kg
Potassium	2-4 mEq/kg	2-4 mEq/kg	1-2 mEq/kg
Calcium	2-4 mEq/kg	0.5-4 mEq/kg	10-20 mEq
Phosphorus	1-2 mmol/kg	0.5-2 mmol/kg	10-40 mmol
Magnesium	0.3-0.5 mEq/kg	0.3-0.5 mEq/kg	10-30 mEq
Acetate	As needed to maintain acid base-balance		
Chloride	As needed to maintain acid base-balance		

**Use caution in prescribing calcium and phosphorus related to compatibility.*

TABLE 7. PN DAILY MULTIPLE VITAMIN PRODUCT DOSING

Manufacturer Recommendations†		NAG-AMA Recommendations◊	
Weight (kg)	**Dose (mL)**	**Weight (kg)**	**Dose (mL)**
Less than 1	1.5	Less than 2.5	2 mL/kg
1 to less than 3	3.25	Greater than or equal to 2.5	5 mL
Greater than 3	5		

† Infuvite Pediatric (Baxter) and M.V.I. Pediatric (Hospira)

◊ Nutrition Advisory Group-American Medical Association

TABLE 8. PN TRACE ELEMENT DAILY DOSING*

Trace Element	Preterm Neonates	Term Neonates 3-10 kg	Children 10-40 kg	Adolescents Greater than 40 kg
Zinc	400 mcg/kg	250 mcg/kg	50 mcg/kg (max 5000 mcg/d)	2-5 mg
Copper	20 mcg/kg	20 mcg/kg	20 mcg/kg (max 500 mcg/d)	200-500 mcg
Manganese	1 mcg/kg	1 mcg/kg	1 mcg/kg (max 55 mcg/d)	40-100 mcg
Chromium	0.05-0.3 mcg/kg	0.2 mcg/kg	0.2 mcg/kg (max 5 mcg/d)	5-15 mcg
Selenium	2 mcg/kg	2 mcg/kg	2 mcg/kg (max 100 mcg/d)	40-60 mcg

**Note: These requirements are different than the multi-trace element products currently available in the US.*

Per Heather Kistler, RD, CSP, LDN
Inpatient Pediatric & Neonatal Dietitian:

In regards to the GIR it's recommended to not start with more than 10% dextrose and if peripheral not to exceed 12.5% dextrose concentration; for central lines not to exceed 25% dextrose concentration.
I do feel that the dosing guidelines for adolescents may end up giving a bit much for a starter TPN. For adolescents I usually start around 150 gm dextrose (even if this is lower than 10% dextrose) and between 1-1.5 g/kg amino acid and around 40gm Lipid (template only lets you dose in gm/kg for Lipid so I typically figure out what the g/kg would be to hit around 40gm Lipid).

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