Children's Hospital of Philadelphia

Nutrition Trainee Reference Sheet

For use with patients ages 1 month (corrected age) to 18 years. Please refer to adult malnutrition criteria for individuals 19 years and older.

Indicators	Severe malnutrition E43	Moderate malnutrition E44.0	Mild malnutrition E44.1
Weight for length Z score	-3 or greater Z score	-2.0 to - 2.99 Z score	-1.0 to -1.99 Z score *
BMI for age Z score	-3 or greater Z score	-2.0 to -2.99 Z score	-1.0 to -1.99 Z score *
Length / Height Z score	-3 or greater Z score	No Data Available	No Data Available
Mid-upper arm circumference (<60 mo or 5 years of age)	-3 or greater Z score	-2.0 to -2.99 Z score	-1.0 to -1.99 Z score
Weight gain velocity (≤2 years of age)	≤25% of norm **	26-50% of norm **	51-75% of norm **
Weight loss (2 to 20 years of age)	> 10% of usual body weight	> 7.5% of usual body weight	> 5% of usual body weight
Deceleration in weight for length/height or BMI for age	Deceleration across 3 Z score lines	Deceleration across 2 Z score lines	Deceleration across 1 Z score line
Inadequate nutrient intake	≤ 25% of est kcal-protein need	26-50% of est kcal-protein need	51-75% of est kcal-protein need

* Consider using additional criteria to support diagnosis (i.e., weight loss, inadequate intake)
** Weight gain increments at the median of the WHO growth velocity standards for the time span between the 2 data points
Use www.peditools.org to obtain Z-scores, WHO for kids under 2, CDC kids 2-20

Weight Gain Velocity

Age	Median g/day	
	Girls	Boys
0-4 wks	29	34
4 wks-2 mo	34	40
2-3 mo	24	27
3-4 mo	20	21
4-5 mo	16	17
5-6 mo	13	14
6-8 mo	11	11
8-10 mo	9	9
10-12 mo	8	8
12-18 mo	7	7
18-24 mo	7	6
2-3 years	6	5.5
3-4 years	5.2	5.5
4-5 years	4.7	5.5
5-6 years	5	5.5
6-7 years	6.3	6
7-8 years	8.2	6.6
8-9 years	10	7.7
9-10 years	11	9
10-11 years	12.3	10.7
11-12 years	12.3	12.3
12-13 years	12.6	14.2
13-14 years	11.5	16
14-15 years	9.3	16.2
15-16 years	6	15

Fiber Intake Goals

Minimum:	Age (years) + 5 g
Maximum:	Age (years) + 10 g

Linear Growth Velocity

Age	cm/week	cm/month
0-4 months	0.8-0.93	3.47-4.03
4-8 months	0.37-0.47	1.61-2.04
8-12 months	0.28-0.37	1.21-1.16
12-16 months	0.24-0.33	1.04-1.43
16-20 months	0.21-0.29	0.91-1.25
20-24 months	0.19-0.26	0.82-1.29
2-3 years		0.7 - 1.1
4-6 years		0.5 - 0.8
7-10 years		0.4 - 0.6

BMI (kg/m2)

	2 to 20 years	Adults < 65
Underweight	< 5th %ile	< 18.5
Normal/healthy weight	5 to < 85th %ile	18.5 to 24.9
Overweight	85 to <95th %ile	25 to 29.9
Obese	≥95th %ile	> 30

Catch Up Growth and Obesity Considerations

	Infants	Children and Adolescents
Underweight Promote catch up growth	Increase needs by ~20kcal/kg	Increase activity factor to adjust overall kcal by 5-10%
Overweight Maintain wt with goal to improve Z-score with linear growth	If reducing kcal, ensure still meeting fluid and protein needs	Reduce Activity Factor **OR** recalculate REE with Adjusted body weight to reduce overall kcal by 5-10%
Ideal Body Wt	BMI at the 50th%-ile for age x ht $(m)^2$	
	Males: 106(lb) + 6(lb) for every inch over 5ft	
	Females: 100(lb) + 5(lb) for every inch over 5ft	
Adjusted Body Wt	[Actual BW (kg) – IBW (kg) x 0.25] + IBW (kg)	

Maintenance Fluid Needs (Holliday-Segar)

1 to 10 kg	100 mL/kg
11 to 20 kg	1000 mL + 50 mL/kg over 10 kg
>20 kg	1500 mL + 20 mL/kg over 20 kg

Calorie & Protein Needs for Healthy Kids

RDA	Male	Female	Protein g/kg
0 to 6 m	108 kcal/kg		1.52 (AI)
7 to 12 m	98 kcal/kg		1.2 (RDA)
1 to 3 y	102 kcal/kg		1.05 (RDA)
4 to 6 y	90 kcal/kg		0.95 (RDA)
7 to 10 y	70 kcal/kg		0.95 (RDA)
11 to 14 y	55 kcal/kg	47 kcal/kg	0.95 (RDA)
15 to 18 y	45 kcal/kg	40 kcal/kg	0.85 (RDA)

Consider:
RDAs (kcal/kg) for kids ≤ 1 year or ≤ 10 kg.
WHO equation (use wt in kg) x activity/stress factor for others.

WHO (REE)	Male	Female
0 to 3 y	60.9W - 54	61.0W - 51
3 to 10 y	22.7W + 495	22.5W + 499
10 to 18 y	17.5W + 651	12.2W + 746
18 to 30 y	15.3W + 679	14.7W + 496

WHO Activity/Stress Factors

WHO x 0.8-1.0 for inactive children or to promote wt loss
WHO x 1.3 for well-nourished child at bedrest with mild/moderate stress.
WHO x 1.5 for active child with mild/moderate stress; inactive child w/severe stress (trauma, or child w/min activity & malnutrition requiring catch up growth sepsis, cancer)
WHO x 1.7 for active child requiring catch-up growth or active child w/severe stress
WHO x 2.5-3.5 for hypermetabolic states, ex: Anorexia Nervosa

Preterm Infants

Preterm: Born 36 6/7 weeks and younger
Use Corrected Age for Growth Assessments until 24 mos

Corrected Age = Actual age in weeks - # of weeks preterm	
Calories: EN: 120-130 kcal/kg PN: 100-110 kcal/kg	Protein: 3.5-4.5 g/kg
Weight gain goals < 37 weeks: 15-20 g/kg/d on average	

Caloric Density Quick Facts

1 ounce = 30 mL
20 kcal/oz = 0.67 kcal/mL (infant standard)
22 kcal/oz = 0.7 3kcal/mL (infant concentrated)
24 kcal/oz = 0.8 kcal/mL (infant concentrated)
27 kcal/oz = 0.9 kcal/mL (infant concentrated)
30 kcal/oz = 1 kcal/mL (pediatric/adult standard)
45 kcal/oz = 1.5 kcal/mL (concentrated)

Vitamin D Considerations

- Infants exclusively breastfed or taking less than 1 liter of formula require 10 mcg (400 IU) supplemental vitamin D (cholecalciferol) per day
- Conversions for Vitamin D:
  - From IU to mcg: IU * 0.025 = mcg
    - Example: 400 IU * 0.025 = 10 mcg
  - From mcg to IU: mcg / 0.025 =IU
    - Example: 50mcg / 0.025 = 2000 IU
- Vitamin D 25OH is the best laboratory measure to assess nutritional vitamin D status. 1,25 is more helpful for assessment of calcium/vit D metabolism and renal or endocrine processes
- Levels >20 ng/mL are considered sufficient but >30 ng/mL optimal for most patient

Refeeding Syndrome Considerations

- Metabolic and functional complications can occur in malnourished patients with rapid introduction of carbohydrates. Insulin surge leads to increased uptake and use of electrolytes intracellularly.
- Risk factors include significant weight loss, prolonged low nutrient intake, high metabolic demand, increased nutrient or electrolyte losses, and/or decreased absorption
- Start low and go slow when starting nutritional therapy
- Monitor for hypophosphatemia, hypokalemia, hypomagnesemia, and thiamine deficiency – consider supplementation
- Anticipate need for electrolyte repletion

The 8 Major Allergens

Cow's milk, egg, fish, shellfish, peanuts, treenuts, wheat, soy

Common Formulas	Protein type	kcal/oz	Protein g/mL	mOsm/kg
Breastmilk (mature)		20	0.011	290
Preterm (≤ 36 6/7 wks)				
Similac Special Care (< 3.5kg)	Standard	24	0.024	280
Neosure (discharge or >3.5kg)	Standard	22	0.021	250
Infant (Full-term - 1 year)				
Similac Pro-Advance	Standard	20	0.014	310
Similac Total Comfort	Partially hydrolyzed	20	0.015	200
Gerber Good Start Gentle	Partially Hydrolyzed	20	0.015	250
Similac Alimentum	Hydrolyzed	20	0.019	370
Alfamino Infant	Elemental Hypoallergenic	20	0.019	330
Elecare Infant Unflavored	Elemental Hypoallergenic	20	0.021	590
Pediatric (1 - 13 years)				
Pediasure Enteral	Standard	30	0.03	340
Compleat Pediatric	Standard	30	0.038	400
Bright Beginnings Soy	Standard	30	0.03	478
Pediasure Peptide	Hydrolyzed	30	0.03	250
Peptamen Jr 1.5 unflavored	Hydrolyzed	45	0.045	430
Neocate Jr unflavored	Elemental Hypoallergenic	30	0.031	600
Adult (13 & up)				
Nutren	Standard	30	0.04	330
Nutren 1.5	Standard	45	0.068	530
Peptamen	Hydrolyzed	30	0.04	340
Peptamen 1.5	Hydrolyzed	45	0.068	585
Vivonex RTF (10% kcal from fat)	Elemental	30	0.05	630
Compleat Organic Blends (chicken-garden variety)	Standard, blenderized	38	0.063	740

Modulars	
MCT Oil	7.7 kcal/mL
Microlipid	4.5 kcal/mL
Liquigen	4.5 kcal/mL
Beneprotein (7g/scoop)	25 kcal + 6g pro/scoop
DuoCal (5g/scoop)	25 kcal/scoop
Liquid Pectin (fiber for bulking)	0 kcal

Creating Gastric Enteral Feeding Regimens

Age	How To Start	How to Advance	Suggested Tolerance Rates/Volume
0-12 Months			
Bolus EN	10-15 mL/kg every 2-3 hrs	10-30 mL per feed	20-30 mL/kg every 4-5 hrs
Continuous EN	1-2 mL/kg/hr	1-2mL/kg every 2-3 hrs	6 mL/kg/hr
1-6 years			
Bolus EN	5-10 mL/kg every 2-3 hrs	30-45 mL per feed	15-20 mL/kg every 4-5 hrs
Continuous EN	1 mL/kg/hr	1 mL/kg every 2-3 hrs	1-5 mL/kg/hr
7-14 years			
Bolus EN	90-120 mL every 3-4 hrs	60-90 mL per feed	330-480 mL every 4-5 hrs
Continuous EN	25 mL/hr	25 mL every 2 to 8 hrs	100-150 mL/hr
>14 years			
Bolus EN	200 mL every 4hrs	100 mL every 4 hrs	Up to 500 mL every 4 hrs
Continuous EN	30-60 mL/hr	30 mL/hr every 2 to 8 hrs	100-150 mL/hr
PICU @ CHOP	Bolus: initiate at 3 mL/kg/feed (max 50 mL/feed), every 3 hrs	Continuous: 1 mL/kg/hr (max 25 mL/hr)	
Consider combining bolus + overnight feeds as an option for PO + EN regimens or volume intolerance			

Information adapted from WHO & CDC Growth and Data tables, Texas Children's Book and *Pediatric Nutrition Support* (Jones and Bartlett). Created November 2019.