

Body composition of children on Home Parenteral Nutrition

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Background

- Patients with intestinal failure are at risk of malnutrition, nutritional deficiencies, metabolic bone disease and reduced muscle mass
- Parenteral nutrition (PN) aims to correct and prevent nutritional deficits and ensure adequate growth in children
- It remains unclear whether adequate PN will also ensure normal bone density and body composition
- Our aim was to assess bone mineral density, bone architecture and body composition in children on long-term home PN

Methods

- All patients on home parenteral nutrition (HPN) for > 1 year, managed in our centre were potentially eligible
- WHO charts were used to calculate Z scores for height, weight and body mass index (BMI)
- Z scores between -1.84 (1st centile) to +1.84 (99th centile) were considered normal
- Dual X-ray Absorptiometry (DXA) scanning was performed to assess bone mineral density (BMD) and body composition (GE Lunar Prodigy)
- High resolution peripheral Quantitative Computerised Tomography (pQCT) scanning was performed to assess left arm muscle mass and bone architecture (Stratec XCT-3000)
- Only those aged >6years however were tested since there are no population norms for DXA and pQCT for younger children

Smoothed Percentage Body Fat Percentiles for U.S. Children and Adolescents, 1999–2004

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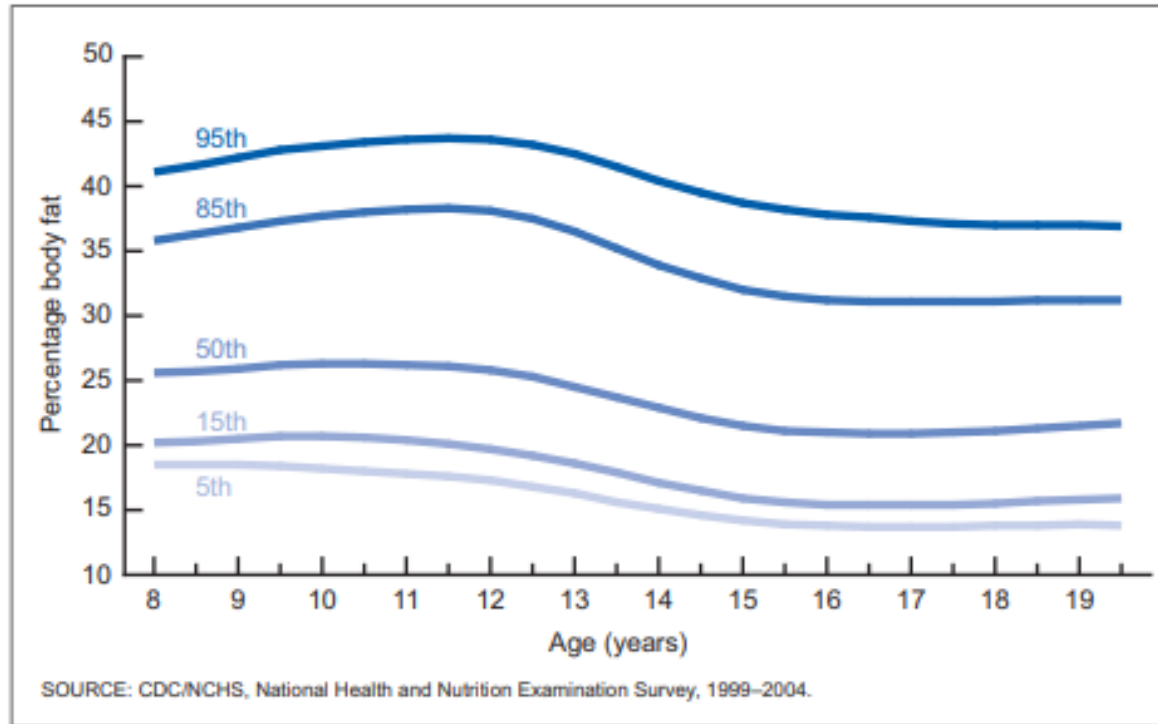


Figure 2. Selected percentiles of smoothed percentage body fat among boys aged 8–19 years: United States, 1999–2004

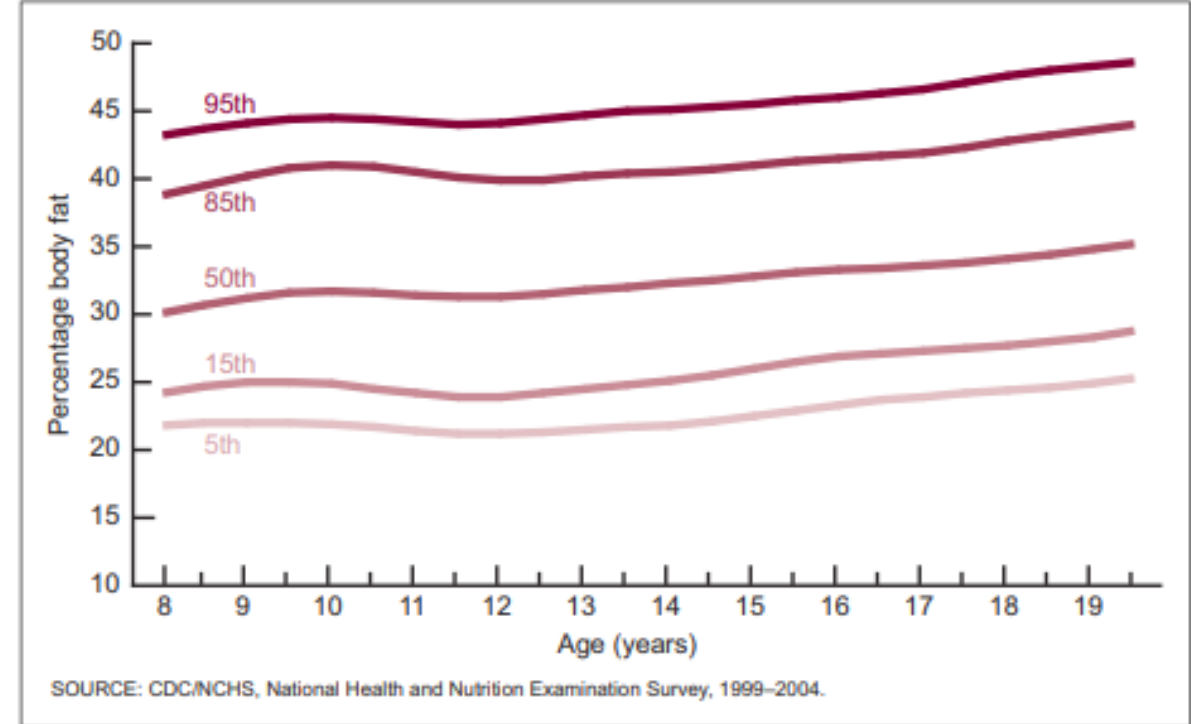


Figure 3. Selected percentiles of smoothed percentage body fat among girls aged 8–19 years: United States, 1999–2004

Results (Demographics)

PATIENT	IF DIAGNOSIS	DURATION PN* (yrs)	HEIGHT Z score	WEIGHT Z score	BMI Z score
F1	MMIHS	10.08	1.04	0.40	0.07
F2	MMIHS	14.27	-0.17	-0.58	-0.55
F3	SBS	1.81	-1.84	-1.84	-0.83
M1	(ultra) SBS	8.55	-0.39	0.0	0.26
M2	Filamen A deficiency	6.81	-1.63	-0.93	0.15
M3	SBS	5.52	-0.80	-0.59	0.01
M4	SBS	9.79	-0.54	-0.15	0.24
MEDIAN		8.55	-0.54	-0.58	0.07

*Duration HPN at time of scan

IF= Intestinal Failure; BMI= Body Mass Index; MMIHS= Megacystis microcolon intestinal hypoperistalsis syndrome; SBS= Short bowel syndrome

Results (DXA Bone Mineral Density)

PATIENT	AGE AT SCAN (yrs)	DURATION PN (yrs)	BMI Z score at scan	Lumbar spine (Z score)	TBLH (Z score)	L femur (Z score)	R femur (Z score)
F1	10.9	10.08	0.07	-0.5	-1.0	-1.4	-1.8
F2	16.6	14.27	-0.55	-2.7	-2.3	-1.3	-1.2
F3	11.0	1.81	-0.83	-1.5	-2.1	-0.2	-0.1
M1	9.3	8.55	0.26	-1.5	-1.5	-0.9	-0.7
M2	10.8	6.81	0.15	-0.7	-2.5	-3.1	-3.1
M3	6.3	5.52	0.01	-0.6	-0.6	-0.6	-1.0
M4	10.7	9.79	0.24	-1.5	-1.2	-0.8	-0.6
MEDIAN	10.8	8.55	0.07	-1.5	-1.5	-0.9	-1.0

DXA: Dual Xray Absorptiometry; BMI=body mass index; TBLH= total body less head

Results (DXA Body Composition)

PATIENT	AGE AT SCAN (yrs)	DURATION HPN (yrs)	BMI (Z score)	BMD TBLH (Z score)	% FAT MASS	LEAN MASS (kg)	% LEAN MASS
F1	10.9	10.08	0.07	-1.0	37.9	24.03	60
F2	16.6	14.27	-0.55	-2.3	30	33.64	67.6
F3	11.0	1.81	-0.83	-2.1	24.5	19.85	72.8
M1	9.3	8.55	0.26	-1.5	26.9	21.1	70.4
M2	10.8	6.81	0.15	-2.5	41.3	20.17	56.8
M3	6.3	5.52	0.01	-0.6	21.3	14.65	75.6
M4	10.7	9.79	0.24	-1.2	34.2	21.38	63.3
MEDIAN	10.8	8.55	0.07	-1.5			

Patients were considered to have increased % Body fat if it was >85th centile

[CL Ogden National Health Statistics Reports 2011; 43: Nov 9,](#)

[I Duran, J Clin Densitometry 2020; 23: 349-363](#)

Patients were considered to have reduced lean mass if it was < 5th Centile for age

[MA Cossio Bolanos Front Endocrinol 2019; 10: 583-588](#)

Results (pQCT Left radius)

PATIENT	AGE AT SCAN (yrs)	DURATION PN (yrs)	BMI AT SCAN (Z score)	MUSCLE AREA (Z Score)	FAT AREA (Z score)	TRABECULAR BONE (Z Score)	CORTICAL BONE (Z score)	TOTAL BONE (Z score)
F1	10.9	10.08	0.07	-3.1	0.3	-1.8	-1.1	-0.8
F2	16.6	14.27	-0.55	-2.0	-0.2	-2.0	-2.2	-1.9
F3	11.0	1.81	-0.83	-1.4	0.2	1.6	-2.7	0.1
M1	9.3	8.55	0.26	-4.2	0.7	1.8	-1.6	0.0
M2	10.8	6.81	0.15	-3.2	0.8	-2.4	0.3	-3.3
M3	6.3	5.52	0.01	-4.6	-0.3	-0.9	-2.1	-0.9
M4	10.7	9.79	0.24	-1.9	0.1	1.3	-0.3	1.0
MEDIAN	10.8	8.55	0.07	-3.1	0.2	-0.9	-1.6	-0.8

Site of central venous line

PATIENT	AGE AT SCAN (yrs)	DURATION PN (yrs)	L ARM MUSCLE (Z score)	L ARM FAT (Z score)	L ARM TOTAL BONE (Z score)	TYPE/SITE CVL
F1	10.9	10.08	-4.9	0.3	-0.8	tc DL CVL into Right IJV
F2	16.6	14.27	-2.0	-0.2	-1.9	Infusaport on Left side
F3	11.0	1.81	-1.4	0.2	0.1	tnc CVL into Left IJV
M1	9.3	8.55	-4.2	0.7	0.0	tc CVL into Right subclavian
M2	10.8	6.81	-3.2	0.8	-3.3	tc CVL into Right IJV
M3	6.3	5.52	-4.6	-0.3	-0.9	tnc CVL into Right IJV
M4	10.7	9.79	-1.9	0.1	1.0	tc CVL into R side SVC
MEDIAN	10.8	8.55	-3.2	0.2	-0.8	

CVL= central venous line; tc= tunnelled cuffed; DL= double lumen; IJV= internal jugular vein;
tnc= tunnelled non cuffed; SVC= superior vena cava

Results Summary

- All patients had normal height, weight, BMI Z-scores
- 3/7 (43%) had low Bone Mineral Density
- 2/7 (29%) had lean mass < 5th centile for age
- 6/7 (86%) had lower left arm muscle mass
 - and it likely wasn't because of their central line was on that side

Conclusions

- Children with intestinal failure remain at risk of low BMD and reduced muscle mass
- Standard anthropometry including height, weight and BMI measurements are not reliable in predicting BMD and lean mass
- Regular DXA scan and body composition assessment should be considered in patients with intestinal failure