Assessment of Growth and Body Composition: Findings From a National Children's Study Workshop

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Workshop Objectives

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- To assess methods for measuring growth and body composition through the lifecycle
- To pay attention to concordance between prenatal and postnatal measurements
- To determine appropriateness of measures for the National Children's Study and where pilot data may be needed
- To develop a list with suggestions for optimal timing of measurement

Pregnancy

Dimension	Method	Timing
Stature	Anthropometer	Once
Segment lengths Knee, sitting height		Once
Circumferences Head Midupper arm Abdomen Thigh	Tape	Once Before, every visit, & PP Before, < 20 wk, & PP Entry, 20, 28, 36 wk, & PP
Subcutaneous fat	Lipometer	Before, during, & PP
Body weight	Scale	Every visit
Body compartments Total & regional LBM, bone, fat	DXA	Before, 6 wk PP
Body water	MF BIA	Entry, 20, 28, 36 wk, & PP
Total body	BIA, Bod Pod	Entry, 20, 28, 36 wk, & PP
Placenta weight		Delivery
Metabolic 2-hr OGTT Inflammatory markers $HbA1_c$		24–28 wk Before, during, & PP Before, entry, 6 wk PP

PP = post partum
MF = multifrequency
DXA = dual-energy X-ray absorptiometry
BIA = bioelectrical impedance analysis

Possible Issues/Pilots

- Subcutaneous fat measurement with Lipometer requires more study, validation
- Non-bone lean body mass (LBM) measurements may require certification
- Body water BIA requires validation of equations
- Regional fat mass – new DXA algorithms for visceral fat

Fetal Growth

Dimension	Method	Timing
BPD/OFD	2D U/S	8–12 wk
Circumferences Head, abdomen, midhumerus, midfemur	2D U/S	18–22, 24–28, 30–34 wk
FL/tibia length	2D U/S	
HL/radius	2D U/S	
Subcutaneous fat Abdominal wall midhumerus, midfemur	2D U/S	18–22, 24–28, 30–34 wk
Organs Right kidney Heart Liver	 2D U/S 2D U/S 2D U/S	
Umbilical artery	Doppler U/S	18–22, 24–28, 30–34 wk
Uterine artery	Doppler U/S	18–22 wk
Saved scans	3D U/S	18–22, 24–28, 30–34 wk

BPD = bi-parietal diameter
2D U/S = 2-dimensional ultrasound
OFD = occipital-frontal diameter
3D U/S = 3-dimensional

Possible Issues/Pilots

- Subcutaneous fat measurement on 2D U/S needs standardization
- Use of 3/D U/S for biometry needs to be assessed

Infant to Age 3 Years

Dimension	Method	Timing
Length	Tape	Birth, 3, 6, 9, 12 mo, q 6 mo
Stature	Stadiometer	2 y, then q 6 mo
Sitting height	NHANES	3, 4 y
Leg length	NHANES	3, 4 y
Circumferences Head Arm Abdomen Thigh	Tape	 Birth, 3, 6, 9, 12 mo, q 6 mo Birth, 3, 6, 9, 12 mo, q 6 mo Birth, 3, 6, 9, 12 mo, q 6 mo Birth, 3, 6, 9, 12 mo, q 6 mo
Arm span	Tape	3, 4 y
Body weight	Digital scale	Birth, 3, 6, 9, 12 mo, q 6 mo
Total lean mass Skeletal muscle Bone mass Body water	DXA DXA DXA D_2O	Birth, 3, 6, 9, 12 mo, q 6 mo Birth, 3, 6, 9, 12 mo, q 6 mo
Total body fat	DXA	
Regional fat	DXA, U/S	Birth, 3, 6, 9, 12 mo, q 6 mo
Skinfolds	Calipers	Birth, 3, 6, 9, 12 mo, q 6

Possible Issues/Pilots

- Circumference and regional fat measurements
- Arm span only when height not feasible

Children, Ages 4–8

Dimension	Method	Timing
Stature/Length	Stadiometer	Every 6 mo
Segment lengths	Anthropometer	Every 6 mo
Circumferences Head, waist	Tape	 Every 6 mo
Skinfolds Subscapular, triceps	Calipers	 Every 6 mo
Body weight	Digital scale	Every 6 mo
Total lean mass Skeletal muscle Bone mass Body water	DXA DXA DXA D_2O	Every year Every year Every year Every 6 mo
Total fat	DXA	Every year
Regional fat	DXA	Every year
Muscle x-section	pQCT	Every year
Breast/genital and pubic hair assessment		6 y and q 6 mo
Month of menarche		6 y and q 6 mo
Blood pressure		Every 6 mo
Grip strength		Every year
Insulin, glucose lipid profiles		6 y and q 6 mo

pQCT = peripheral quantitative computed tomography

Possible Issues/Pilots

- Waist circumference terminology needs to be consistent
- Body water measures need to be validated
- DXA equations should be updated

Adolescents, Ages 9–19

Dimension	Method	Timing
Protocol as for children, plus		Every year
Diameters Sagittal abdominal	Caliper	Every year
Subcutaneous fat Trunk, calf	Caliper	Every year
Hemi armspan	Tape	Once at 18+ yrs

Main Conclusion:

Aside from anthropometry, DXA may be the most important measurement to obtain for assessment of body composition in infants and children.

Nutritionist Janet Gilchrist (FDA) analyzes a DXA scan completed on a 6-month-old boy. Photo by Stephen Ausmus. Image Number K10900–1.

Implementing the National Children's Study:
Scientific Progress, Challenges, and Opportunities

Study Assembly Meeting

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