Body Mass Index and Gait in Children Ages 9-14

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Objective

- Compare temporospatial gait characteristics and anthropomorphic measures of children ages 9-14, who are considered overweight for age with children who have a typical weight for age

Rationale

- Obesity is now an epidemic, carrying over from childhood into adulthood
- Causes orthopedic complications:
  - Slipped capital femoral epiphysis
  - Avascular necrosis of the femoral head
  - Rotational and angular deformities of long bones of lower extremities

Previous Studies

- Compared groups of children who are overweight and non-overweight at fast, normal, and slow speeds
- Assessed:
  - Double Support
  - Cadence
  - Velocity
  - Relative Velocity
  - Cycle Duration
  - Stance Time
  - Swing Time
  - Single Support
  - Step Length
  - Stride Length

Previous findings in children classified as overweight[1,2,3]

- Double Support was increased
- Cadence was decreased
- Velocity was decreased
- Relative Velocity was decreased
- Cycle Duration was increased

Referenced from:

1. Hills AP, Parker AW. Locomotor Characteristics of Obese Children. *Child Care Health Dev.* 1992;18:29-34
2. Hills AP, Parker AW. Gait Characterisitics of Obese Children. *Arch Phys Med Rehabil.* 1991;72:403-407
3. McGraw B, McClenaghan BA, Williams HG, Dickerson J, Ward DS. Gait and postural stability in obese and nonobese prepubertal boys. *Arch Phys Med Rahabil.* 2000;81:484-489

Inclusion Criteria

- Between ages of 7-14
- No history of heart problems (i.e. pacemaker)
- No history of any LE surgeries or gait impairments
- Total of 27 children
  - Two were not used 2° incomplete data and inconsistent data

Sample

- Sample of convenience of children with unimpaired gait from:
  - David-Brainerd Christian School
  - East Lake Community Center after-school program
  - Other
- Data set consisted of 25 children
  - 13 Girls
  - 12 Boys

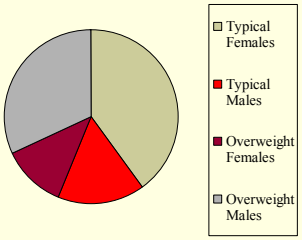
Sample

Typical

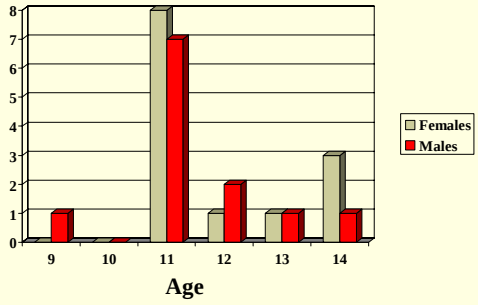
- 14 were below the 95th percentile
  - 4 males
  - 10 females

Overweight

- 11 were at/above the 95th percentile of BMI for age and gender
  - 8 males
  - 3 females



Sample



Method

- Obtained approval from UTC IRB
- Obtained informed consent and questionnaire
- Obtained appropriate permission prior to entering facilities

Method

- Objective information obtained through:
  - Tape measure assessments
  - Goniometric measures
  - Skinfold calipers – Slim Guide
  - Tanita® TBF-300A
  - GAITRite®
  - CDC charts

Tools Utilized

- GAITRite®
  - Portable 4.6mx0.9m mat
  - Active measurement area of 3.7mx0.6m
  - Used 2m before & after
  - Measures
    - Step length
    - Stride length
    - Heel-to-heel BOS
    - Single support time
    - Double support time
    - Walking speed
    - Step time

www.biometrics.nl/ html/Images/GTxx.GIF

Tools Utilized

- Skinfold Caliper
  - Triceps
  - Subscapular
  - Medial Calf
- Tanita®
  - Weight & BMI
- CDC BMI Charts
  (Normalized for age and gender)
  - Boys 2-20 years
  - Girls 2-20 years

www.morleyathletic.com/ images/M15451.jpg

Tools Utilized

- Goniometer
  - Hip flexion/extension
  - Knee flexion/extension
  - Hindfoot varus/valgus
  - Ankle plantarflexion/ dorsiflexion
- Measuring Tape
  - Child's height
  - Leg Lengths

www.yogatherapycenter.org/ images/goniometer.jpg

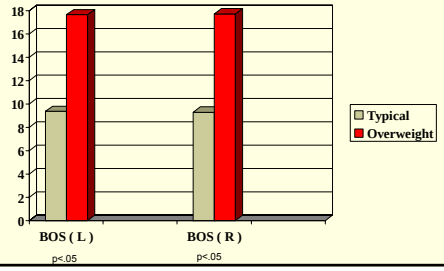
Method

- Instructed participant to empty bladder
- Gathered body composition
- Ambulate*across GAITRite®
  - Self-selected (3 trials)
  - Slower (3 trials)
  - Faster (3 trials)

*Originally, we had planned to use an electric metronome to standardize fast and slow speeds…

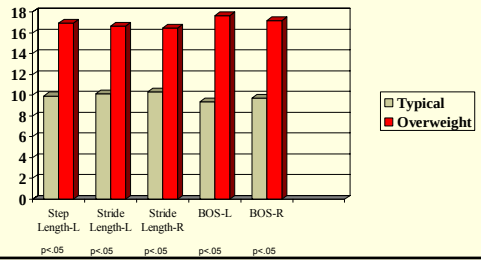
Results

- Mann-Whitney U
  - Mean Ranks for Slower Speed



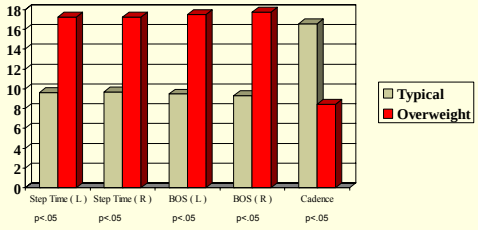
Results

- Mann-Whitney U
  - Mean Ranks for Self-Selected Speed

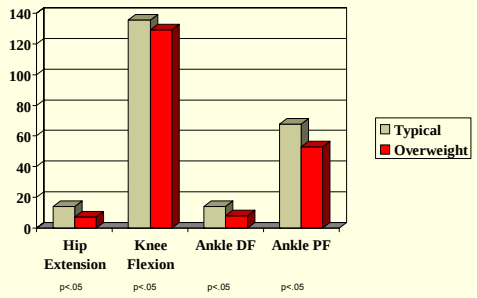


Results

- Mann-Whitney U
  - Mean Ranks for Faster Speed



Comparison of Mean ROM



Possible Explanations

- ↑ BOS in overweight children at all speeds
  - ↑ leg girth, ↑ pelvic width
- ↑ Step time in overweight children at fast speed
  - Deconditioned
- ↑ Step length and stride length in overweight children at self-selected speed
  - Adaptation to keep up with peers

Comparison of Studies

	Hills AP & Parker AW[1]	Hills AP & Parker AW[2]	McGraw, et al.[3]	This Study
Stride Length				↑ (at self-selected speed)
Step Length				↑ (left at self-selected speed)
Double Support		↑	↑	
Cadence	↓	↓		↓ (at faster speed)
Velocity	↓			
Relative Velocity	↓	↓		NT
BOS				↑
Step Time				↑ (at faster speed)

- Our findings do not completely correlate with previous studies

Possible sources of discrepancy

- Leg length measurements (intra-rater reliability)
- Child's gait pattern at differing speeds
  - Peer observation
- Tanita® – control of variables
- Sample size
- Sample distribution
- Some other studies solely used males
- This study had a wider age range of subjects

Future Research

- Larger sample of participants
- Better age/gender-matched distribution of participants
- Explain differences in temporospatial gait parameters
- Development of a gait maturity index that accounts for differences in height and age

Reference List

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Questions?

And we're done!