

## Relationship of Body Composition, Fitness, and Motor Proficiency In Pre-Pubescent Children

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### Introduction:

- Obesity is an important public health issue in the United States.
- National Center for Health Statistics (NCHS)<sup>1</sup>: 1 in 5 children in the United States is now overweight.
- Obesity can cause complications in many organ systems during childhood.
  - *Orthopedic complications*
    - e.g. slipped capital femoral epiphysis or Blount's Disease
  - *Cardiac disease*
  - *Diabetes*

### Background:

- Overweight for age > more sedentary lifestyle and lower physical activity levels
- Overweight & sedentary lifestyle > reduced motor coordination & decreased fitness levels
- Decreased fitness levels and reduced motor coordination > lack of persistence of children in working to increase physical activity levels on a long-term basis.

### Purpose:

- Children who are overweight for age vs. age-matched and gender-matched peers who are not overweight.
- To compare the strength of relationship among:
  - *Body Composition*
  - *Motor proficiency*
  - *Physical Fitness*
  - *Activity Levels*
- Results may provide information to help future designs of exercises that may improve the motor proficiency (agility, speed, balance), activity level, and fitness of children who are overweight.

### Literature Review: *Going et. al*<sup>2</sup>

- Males and females aged 5-18 years old
  - Males ( $\geq 25\%$  body fat) & females ( $\geq 30\%$ )  $\rightarrow$  3-7 times more likely to have high BP and high cholesterol
- Factors that can influence the effects of exercise programs are:
  - exercise adherence, diet, age, gender, and type of exercise

### Literature Review<sup>1</sup>: Fitnessgram

- Changes during maturation affect both genders differently on  $VO_{2max}$
- Boys:  $VO_{2max}$  stays constant relative to body weight
- Girls:  $VO_{2max}$  remains constant between ages 5-10 but decreases afterwards
  - Likely due to sex-specific essential fat

## Literature Review: Self concept

- *Sherman et al*<sup>5</sup>:
  - Intervention program on children who are obese
  - Weight status—Skinfold calipers
  - Self-esteem—Rosenberg and Simmons Questionnaire
  - Weight status did not show improvement.
    - **self-esteem increased significantly!**

## Research Hypothesis:

- **R1:** Children who demonstrate **higher fitness levels** will have **greater motor coordination** as assessed by the Bruininks-Oseretsky Test of Motor Proficiency than children who are less physically fit.
- **R2:** Children who have **lower body fat percentage** for age will have **higher fitness levels** as determined by the Fitnessgram
- **R3:** Children who are **not overweight** for age will have **greater motor coordination** as assessed by the Bruininks-Oseretsky Test of Motor Proficiency than children who are overweight for age.
- **R4:** Children who are **not overweight** for age will have **higher self-concept** as measured by the Piers-Harris Self Concept 2.

## Subjects:

- Inclusion criteria:
  - Ages 9-14
  - Overweight
    - BMI > 95<sup>th</sup> percentile for age
- Exclusion criteria:
  - Injury or illness that will impact their activity level or proficiency on age appropriate gross and fine motor skills

## Methods and Procedures:

- Informed consent obtained
- Assessments used:
  - Body Mass Index (BMI)
  - Body fat percentage
    - *Tanita TBF 300A Body Composition Analyzer*
  - Motor Proficiency
    - *Bruininks-Oseretsky Test - short form*
  - Piers-Harris Self Concept Scale 2
  - FitnessGram
  - ActivityGram

## Motor Proficiency: Bruninks-Oseretsky Test (Short form)

- Ages 4-14
- 8 subsets of gross and fine motor skills:
  - Running speed and agility
  - Fine Balance
  - Bilateral coordination
  - Upper-limb coordination
  - Response speed
  - Visual-motor control
  - Upper-limb speed and dexterity

## Fitnessgram:

- Assesses 3 different areas of fitness:
  1. **Aerobic Capacity**
  2. **Muscle Strength, Endurance, & Flexibility**
  3. **Body Composition (% body fat)**
- Criterion-referenced standards based on studies performed by Dr. Steve Blair
  - bottom 20% of sample population were at significant risk for CHD and early death
- Determine if in **Healthy Fitness Zone (HFZ)**



## Piers-Harris Domains:

- Measures overall **self-concept**, or “TOTAL” score and 6 domains:
  - 1) Behavioral Adjustment
  - 2) Intellectual and School Status
  - 3) Physical Appearance and Attributes
  - 4) Freedom from Anxiety
  - 5) Popularity
  - 6) Happiness and Satisfaction

## Data Collection:

- Local Christian school
  - 6<sup>th</sup> graders
  - Blocked P.E. Time
  - Sample of convenience
- Local community recreational center
  - After-school program
  - Grades 4-9

## Statistical Analysis:

- Excel worksheet
- SPSS
- Mann Whitney U
  - Non-parametric equivalent of the independent t-test
  - Small sample size; not randomized sample
- Spearman’s Rho
  - Non-parametric equivalent of the Pearson Corr.

## Demographics

	N=10	Overweight	Not Overweight
<b>Age</b>		$\bar{x} = 11.1$	$\bar{x} = 12.0$
<b>Gender</b>			
<i>Male</i>		3	2
<i>Female</i>		0	5
<b>BMI</b>		$\bar{x} = 37.5$	$\bar{x} = 21.6$

## Null Hypothesis 1

- H<sub>01</sub>: Children who demonstrate **higher fitness** levels will **not** have **greater motor coordination** (as assessed by the **Bruininks-Oseretsky** Test of Motor Proficiency) than children who are less physically fit.

## H<sub>01</sub> – Aerobic capacity

Ranks				
	FG VO2	N	Mean Rank	Sum of Ranks
% Rank	outside HFZ	6	3.50	21.00
	IN HFZ	4	8.50	34.00
	Total	10		

P < 0.05

Shows **significance** that those who fall outside of the Healthy Fitness Zone for aerobic capacity (FG VO2 max) have lower Bruininks-Oseretsky % Rank scores

## H<sub>01</sub> – Abdominal strength

Ranks				
	FG curl	N	Mean Rank	Sum of Ranks
% Rank	outside HFZ	6	4.00	24.00
	IN HFZ	4	7.75	31.00
	Total	10		

P > 0.05

Does **not** show significance that those outside of the Healthy Fitness Zone for abdominal strength (FG curl) have lower Bruininks % Rank scores

## H<sub>01</sub> – Trunk strength

Ranks				
	FG ext	N	Mean Rank	Sum of Ranks
% Rank	outside HFZ	0 <sup>a</sup>	.00	.00
	IN HFZ	10	5.50	55.00
	Total	10		

a. Mann-Whitney Test cannot be performed on empty groups.

All subjects were able to meet Healthy Fitness Zone standards in terms of trunk strength (FG ext).

## H<sub>01</sub> – UE strength

Ranks				
	FG push	N	Mean Rank	Sum of Ranks
% Rank	outside HFZ	7	4.29	30.00
	IN HFZ	3	8.33	25.00
	Total	10		

P = 0.05

Does **not** show significance that those outside of the Healthy Fitness Zone for UE strength (FG push) have lower Bruininks % Rank scores

## H<sub>01</sub> – fat %

Ranks				
	FG fat %	N	Mean Rank	Sum of Ranks
% Rank	outside HFZ	6	4.00	24.00
	IN HFZ	4	7.75	31.00
	Total	10		

P > 0.05

- Does **not** show significance that those outside of the Healthy Fitness Zone for percent body fat (FG fat%) have lower Bruininks % Rank scores

## Summary of H<sub>01</sub>

- Only 1 of 5 showed significance
- Null hypothesis was proven
- Children with higher fitness levels did **not** necessarily have higher scores on the Bruininks

## Null Hypothesis 2

- H<sub>02</sub>: Children who have **lower body fat percentage** for age will **not** have **higher fitness** levels (as determined by the Fitnessgram)

## H<sub>02</sub> - Aerobic capacity

Ranks				
FG VO2	N	Mean Rank	Sum of Ranks	
Fat % outside HFZ	6	7.00	42.00	
IN HFZ	4	3.25	13.00	
Total	10			

P > 0.05

Does **not** show significance that those with a lower body fat % fall within the Healthy Fitness Zone

## H<sub>02</sub>

Ranks				
FG curl	N	Mean Rank	Sum of Ranks	
Fat % outside HFZ	6	7.50	45.00	
IN HFZ	4	2.50	10.00	
Total	10			

P < 0.05

Shows **significance** that those with a lower body fat % fall within of the Healthy Fitness Zone for abdominal strength (FG curl)

## H<sub>02</sub> - trunk strength

Ranks				
FG ext	N	Mean Rank	Sum of Ranks	
Fat % outside HFZ	0 <sup>a</sup>	.00	.00	
IN HFZ	10	5.50	55.00	
Total	10			

a. Mann-Whitney Test cannot be performed on empty groups.

All subjects were able to meet Healthy Fitness Zone standards in terms of trunk strength (FG ext).

## H<sub>02</sub> - UE strength

Ranks				
FG push	N	Mean Rank	Sum of Ranks	
Fat % outside HFZ	7	7.00	49.00	
IN HFZ	3	2.00	6.00	
Total	10			

P < 0.05

Shows **significance** that those with a lower body fat % fall within of the Healthy Fitness Zone for UE strength (FG push)

## Summary H<sub>02</sub>

- 2 show significance
- 2 no significance
- Fat % the same – so not considered
- Split results 2:2
- Thus, **neither** proved nor disproved
- Children with a lower body fat % did **not necessarily** have higher fitness levels using the FitnessGram

## Null Hypothesis 3

- H<sub>03</sub>: Children who are **not overweight** for age will **not** have **greater motor coordination** (as assessed by the **Bruininks-Oseretsky Test of Motor Proficiency**) than children who are overweight for age.

## Bruininks % Rank vs. Overweight

Ranks			
BMI >95	N	Mean Rank	Sum of Ranks
% Rank Not overweight	7	6.71	47.00
Overweight	3	2.67	8.00
Total	10		

P = 0.05

- **No** significance that children who are not overweight will have higher motor proficiency scores on the Bruininks

## Null Hypothesis 4

- $H_{04}$ : Children who are **not overweight** for age will **not** have **higher self-concept** (as measured by the Piers-Harris Self Concept 2).

## Summary of $H_{04}$

Ranks			
Obese (>95)	N	Mean Rank	Sum of Ranks
Piers Not overweight	7	5.43	38.00
Overweight	3	5.67	17.00
Total	10		

P > 0.05

- **No** significance that children who are not overweight have a higher self esteem on the Piers-Harris Self Concept Scale 2.

## Comparison to Literature:

- Our results dispute the generally accepted ideas regarding body composition, motor proficiency/coordination, and fitness

## Correlations:

Correlations					
		BMI	Fat %	% Rank	Piers
Spearman's rho	BMI	1.000	.806**	-.816**	-.215
	Correlation Coefficient		.005	.004	.551
	Sig. (2-tailed)		10	10	10
Fat %	Correlation Coefficient	.806**	1.000	-.644*	-.043
	Sig. (2-tailed)	.005		.044	.906
	N	10	10	10	10
% Rank	Correlation Coefficient	-.816**	-.644*	1.000	.329
	Sig. (2-tailed)	.004	.044		.353
	N	10	10	10	10
Piers	Correlation Coefficient	-.215	-.043	.329	1.000
	Sig. (2-tailed)	.551	.906	.353	
	N	10	10	10	10

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

## Correlation summary:

- As fat % increased, BMI increased
- As BMI increased, Bruininks % Rank dec.
- As fat % increased, Bruininks % dec.

## Support of Literature:

- Our study supports general ideas of literature:
  - Correlation between **body fat %** and **BMI** in children
  - Correlation between **BMI** and **motor proficiency**
  - Correlation between **body fat %** and **motor proficiency**

## Limitations:

- Access to “Overweight” kids
  - Available resources
  - Multiple resources
- Ethical concerns
- Time restraints
- Hawthorne Effect
- Tests were not administered in same order
- ActivityGram not obtained

## Strengths:

- Used all standardized tests
  - Piers-Harris has “validity” score factored into it
- Easily reproducible
- Study addresses relevant healthcare issue in U.S.

## Suggestions:

- Multiple Resources/Settings
  - *Subjects*
  - *Back up plan*
- Begin early (summer ?)
- Parental Involvement
- Participants for exercise programs
- Rewards
- Race
- Income related
- Nutrition
- ActivityGram

## Conclusions / Recommendations:

- Due to small sample size, our results did not provide conclusive evidence to show support for or against our hypotheses
- Need to increase sample size for further studies
- Future performances should be consistent in maintaining strict testing procedures

## ?? Questions ??

