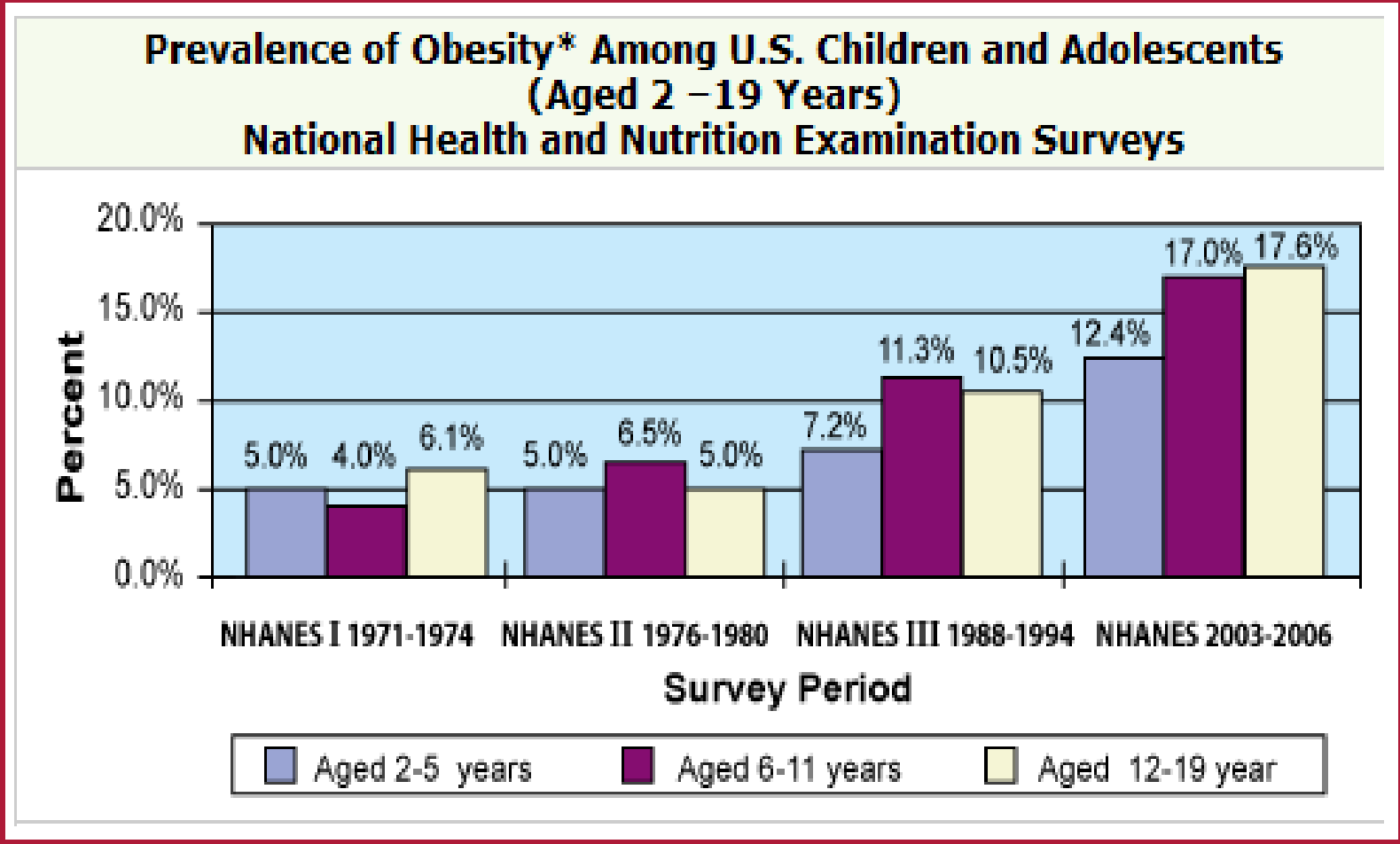
Associations among physical activity, diet and weight status in 6th grade children

Sharon Taverno Ross, Ph.D.
Post-doctoral Fellow
University of South Carolina

Background


Prevalence of Obesity* Among U.S. Children and Adolescents
(Aged 2 –19 Years)
National Health and Nutrition Examination Surveys
Percent
20.0%
15.0%
10.0%
5.0%
0.0%
5.0%
4.0%
6.1%
5.0%
6.5%
5.0%
7.2%
11.3%
10.5%
12.4%
17.0%
17.6%
NHANES I 1971-1974
NHANES II 1976-1980
NHANES III 1988-1994
NHANES 2003-2006
Survey Period
Aged 2-5 years
Aged 6-11 years
Aged 12-19 year

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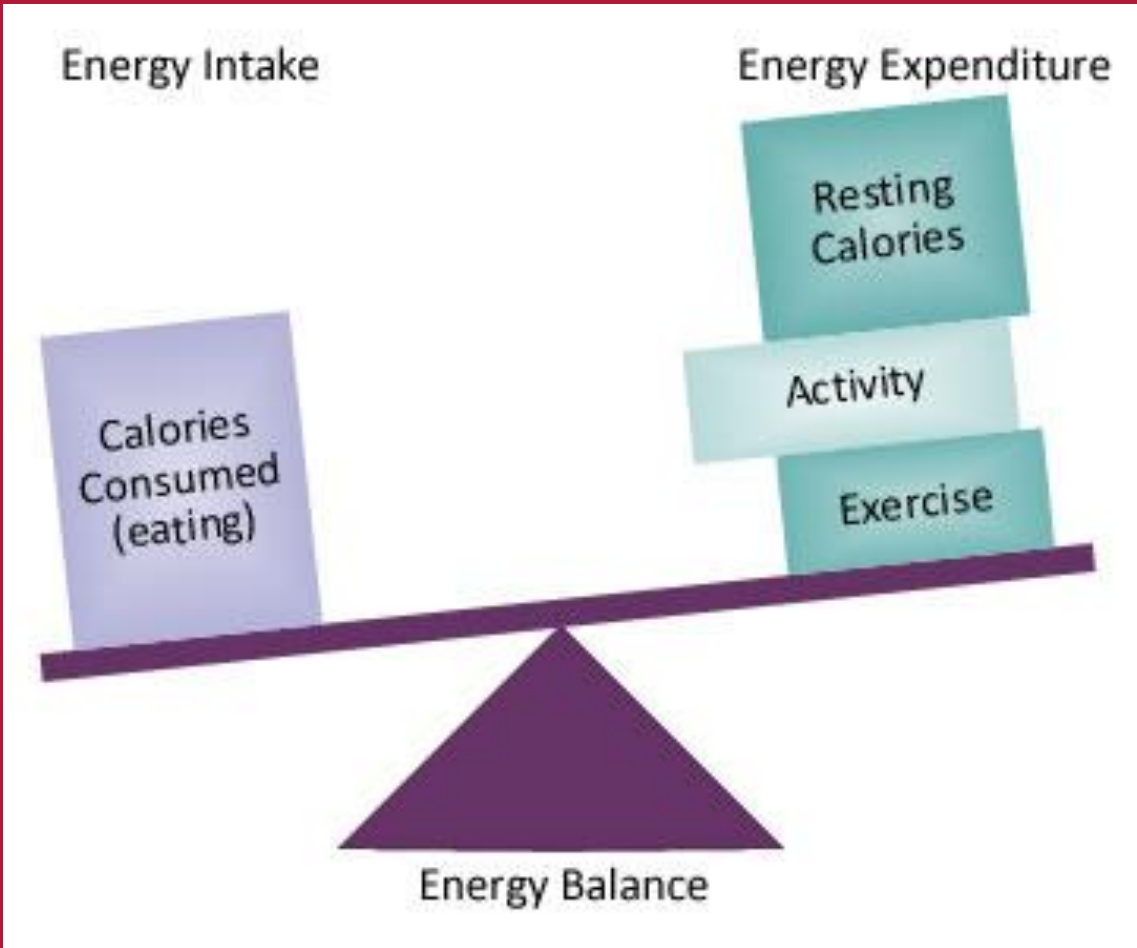
Energy Intake
Energy Expenditure
Resting Calories
Activity
Exercise
Calories Consumed (eating)
Energy Balance

Purpose

- To investigate the associations among physical activity, diet, and weight status in 6th grade children

- TRACK - 5th, 6th, 7th grades
- 21 elementary schools, 2 districts
- 1087 children (505 boys, 582 girls)
- Ethnically diverse sample

Study design

- Cross-sectional
- 13 middle schools
- 562 6th grade students with complete data on variables of interest
  - 261 boys, 301 girls

Participant Characteristics

- 11.5 ± 0.5 years
- 42% white, 32% black, 18% other, 8% Hispanic
- 45% overweight/obese*

*BMI ≥ 85th percentile

Physical Activity

- Accelerometry (Actigraph GT1M & GT3X)
- 7 consecutive days except sleeping, bathing or swimming
- Compliance = 8 or more hours per day
- 2200 counts/min MVPA threshold (4.0 METs)
- <100 counts/min Sedentary

Dietary intake

- BLOCK kids food screener (last week)
- 41 food items
  - Yes/No, portion sizes (a little, some, a lot)
- Dietary variables:
  - fruits and vegetables (cup equivalents)
  - dietary fiber (grams/1000 kcal)
  - added sugar (tsp/day)
  - dietary fat (% total energy)

Weight status

- Body mass index (BMI) z-score
  - body weight [kg] / height $[m]^2$
- % Body fat
  - Equation using bioelectrical impedence[1]

Characteristic	Boys (n=261)	Girls (n=301)	p-value
BMI	21.3 (4.8)	22.2 (5.4)	**.04**
BMI z-score	0.83 (1.0)	0.88 (1.0)	.57
% Overweight/ obese	44.8%	46.5%	.69
Percent Body Fat	21.0 (9.5)	27.5 (10.0)	**<.001**

1. Horlick M, et al. (2002). *Am J Clin Nutr*.

Maturity Offset

- Mirwald et al.[2] - gender-specific equations
  - Non-invasive
  - Predicts years from peak height velocity with anthropometric variables

2. Mirwald RL, Baxter-Jones ADG, Bailey DA, Beunen GP. (2002). *Med Sci Sport Exerc*.

Statistical Analysis

- Mixed model regression
  - Model 1 – PA
  - Model 2 – Diet
  - Model 3 – PA & diet with maturity
- Covariates – age, race/ethnicity, parent ed.
- School & district as random variables

Results – M (SD) or %

Variable	Boys (n=261)	Girls (n=301)	p-value
MVPA, min/hr	3.5 (1.9)	1.8 (1.0)	**<.001**
Sedentary, min/hr	34.1 (4.0)	36.9 (4.5)	**<.001**
Dietary Fiber, g/1000 kcal	7.5 (2.7)	7.8 (2.7)	.16
Dietary fat, % total energy	34.4 (6.8)	33.5 (6.6)	.11
Fruits & veg, cup equivalents/day	2.0 (1.6)	1.9 (1.4)	.63
Added sugar, tsp/day	10.3 (7.3)	9.7 (8.6)	.41
Maturity offset	-1.87 (0.7)	.001 (0.7)	**<.001**

Mixed models – Boys

Model 1	BMI z-score	% Body Fat
MVPA	-.04 (0.4)	**-.75 (.35)***
Sedentary	.04 (0.2) †	**.35 (.16)***

Model 2	BMI z-score	% Body Fat
F/V	.03 (.05)	.13 (.44)
Fiber	-0.1 (.03)	.02 (.29)
Dietary fat	-.02 (0.1)†	-.11(.09)
Added sugar	**-.02 (.01)***	-.13 (.09)

Model 3	BMI z-score	% Body Fat
MVPA	-.01 (.03)	-.58 (.32)†
Sedentary	-.007 (.01)	.12 (.15)
F/V	.01 (.04)	-.001 (.39)
Fiber	-.03 (.02)	-.11 (.26)
Dietary fat	**-.02 (.01)***	-.07 (.08)
Added sugar	**-.02 (.01)****	-.09 (.08)

**p < .01 *p < .05
†p < .10

Mixed models – Girls

Model 1	BMI z-score	% Body Fat
MVPA	**-.23 (0.6)*** **	**-2.25 (.64)*** **
Sedentary	.01 (0.2)	.17 (.15)

Model 2	BMI z-score	% Body Fat
F/V	-.01 (.05)	.11 (.54)
Fiber	.01 (.02)	.16 (.28)
Dietary fat	-.005 (.01)	-.09 (.10)
Added sugar	-.01 (.01)	-.10 (.08)

Model 3	BMI z-score	% Body Fat
MVPA	**-.16 (.05)** **	**-1.68 (.52)** **
Sedentary	-.02 (.01)	-.06 (.12)
F/V	-.03 (.04)	-.16 (.42)
Fiber	-.01 (.02)	-.02 (.22)
Dietary fat	-.002 (.01)	-.06 (.07)
Added sugar	-.002 (.01)	-.05 (.07)

***p < .001 **p < .01

Discussion

- Corroborates previous studies with children & adults:
  - Girls – MVPA inverse relationship with weight status
- In contrast to the Dietary Guidelines, but in agreement with some previous studies:
  - Boys – Added sugar & % dietary fat inverse relationship with BMI z-score

Strengths & Limitations

- Diverse sample
- Measures – objective PA & validated FFQ

- Diet variables may be underestimated
- Accelerometry does not capture swimming, biking or climbing
- Cross-sectional

Next steps

- Examine relationship between weight status, diet and PA as boys and girls transition from elementary to middle school

Acknowledgements

- Dr. Russell Pate – PI
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Sharon Taverno Ross sross@mailbox.sc.edu

QUESTIONS?