UNIVERSITY OF SOUTH CAROLINA

Vigorous Physical Activity is Independently Associated with Markers of Adiposity and Cardiometabolic Risk in Youth

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Presenter Disclosures

- Justin B. Moore has no personal financial relationships with commercial interests relevant to this presentation that existed during the past 12 months.

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- Study participants from the contributing studies:

ALSPAC	TAAG	KISS
Ballabeina Study	CLAN	MAGIC
Belgium Pre-school Study	HEAPS	NHANES
CHAMPS-UK	CoSCIS	PEACH
CHAMPS-US	Pelotas (1993)	SPEEDY
EYHS Denmark/Norway/Estonia/Portugal		

http://www.mrc-epid.cam.ac.uk/research/studies/icad

Presentation Objectives

- Describe physical activity levels and cardiometabolic risk factors in youth.
- Describe the time spent in physical activity by intensity in youth.
- Describe associations between vigorous physical activity (VPA), adiposity, and cardiometabolic risk factors in youth.

VPA, Adiposity, and Cardiometabolic Risk in Youth

INTRODUCTION

Current PA Guidelines for Youth

- 60 minutes or more of daily physical activity (PA) that is at least moderate:
  - Most of the 1+ hours a day should be either moderate- or vigorous-intensity aerobic physical activity.
  - Do vigorous-intensity physical activity 3+ days a week.
  - Include muscle-strengthening activities 3+ days a week.
  - Include bone-strengthening activities 3+ days a week.
- It is important to encourage young people to participate in physical activities that are age appropriate, enjoyable, and offer variety.

http://www.health.gov/paguidelines/

Relationship between PA Intensity and Cardiometabolic Health in Youth

- Benefits of PA are well established, but little is know about the relationship of PA intensity and markers cardiometabolic health in youth.
- Previous and ongoing reviews have shown that vigorous physical activity (VPA) is;
  - negatively associated with adiposity/weight status
  - positively associated with cardiorespiratory fitness.
- The association of cardiometabolic biomarkers with VPA is equivocal, but much of this can be attributed to small sample sizes and/or low methodological quality.

The international Children's Accelerometry Database (ICAD)

- ICAD is a consortium including 20 partners, which pooled and reduced raw accelerometer data to create comparable outcome variables in 32,000 young people aged 3 to 18 years across studies from Europe, the US, Brazil, and Australia.
- ICAD includes accelerometer data from youth along with a variety of cardiometabolic markers.
- Cardiometabolic markers of interest include:
  - Adiposity
  - Lipids
    - Cholesterol
    - Triglycerides
  - Blood pressure
  - Glucose
  - Insulin

ICAD results

- Previously, Ekelund et al. (2012) found that MVPA in youth was associated with better cardiometabolic risk factors regardless of the amount of sedentary time.

	No. (%)		
	Boys (n = 10 098)	Girls (n = 10 773)	*P* Value[b]
Physical activity			
Total activity, cpm	642 (226)	540 (193)	<.001
Sedentary, min/d	345 (96)	363 (96)	<.001
MVPA, min/d	37 (23)	24 (17)	<.001

JAMA. 2012;307(7):704-712

Objective

- The objective of the present investigation is to determine the independent association of VPA with adiposity and cardiometabolic biomarkers in youth.

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METHOD

Analyses

- Accelerometer data from:
  - 11,588 children (4-18yrs)
  - 11 studies from the ICAD
- The relationship between cardio-metabolic risk factors and 4 categories of VPA min/ were examined using quantile regression modeling for each risk factor (controlling for age, sex, wear time, sedentary min/d, MPA min/d) at the 10th, 25th, 50th, 75th, and 90th percentile of the distribution.
- Meta-analytical techniques were used to pool the relationships across studies.
- Risk factors:
  - waist circumference
  - systolic and diastolic BP
  - fasting triglycerides
  - HDL
  - LDL
  - Insulin
- VPA categories:
  - none [0min/d (REF)]
  - low [2.9min/d]
  - medium [10.8min/d]
  - high [25.0min/d])

Table 1.
Studies contributing data

Study ID	Study Name	Abbreviation
1	Avon Longitudinal Study of Parents and Children	(ALSPAC)
4	Copenhagen School Child Intervention Study	(CSCIS)
5	Denmark European Youth Heart Study	(Denmark EYHS)
6	Estonia European Youth Heart Study	(Estonia EYHS)
9	Movement and Activity Glasgow Intervention in Children	(MAGIC)
10	National Health and Nutrition Examination Survey (2005.06)	(NHANES 2005-6)
11	Norway European Youth Heart Study	(Norway EYHS)
12	National Health and Nutrition Examination Survey (2005.06)	(NHANES 2003-4)
14	Pelotas 1993 Birth Cohort	(Pelotas)
15	Portugal European Youth Heart Study	(Portugal EYHS)
20	Kinder-Sportstudie Study	(KISS)

Table 2.
Risk Factors Measured by Studies contributing data

Study	Kinder-Sportstudie Study	Portugal European Youth Heart Study	Pelotas 1993 Birth Cohort	National Health and Nutrition Examination Survey (2005.06)	Norway European Youth Heart Study	National Health and Nutrition Examination Survey (2005.06)	Movement and Activity Glasgow Intervention in Children	Estonia European Youth Heart Study	Denmark European Youth Heart Study	Copenhagen School Child Intervention Study	Avon Longitudinal Study of Parents and Children	Total
Cardiometabolic Risk Factor												
DBP, mm Hg		•	•	•	•	•	•	•	•	•	•	10
SBP, mm Hg		•	•	•	•	•	•	•	•	•	•	10
HDL Cholesterol, mg/dL	•	•		•	•	•		•	•	•		7
LDL Cholesterol, mg/dL	•	•		•	•	•		•	•	•		7
Glucose, mmol/L	•	•		•		•		•	•	•		6
Circumference, mm		•	•		•			•	•	•	•	7
Insulin, pmol/L	•	•		•		•		•	•	•		7
Triglycerides, mg/dL	•	•		•	•	•		•	•	•		8
Total Factors Measured	5	8	3	7	6	8	2	8	8	8	3	

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RESULTS

Results

- Across risk-factors and independent of sedentary and MPA, dose-response relationships were observed for:
  - waist circumference
  - fasting insulin
- For waist circumference, high, medium, and low VPA levels were associated with a corresponding reduction of:
  - -6.1 to -2.0cm (90th percentile)
  - -3.1 to -1.0cm (75th percentile)
  - -1.3 to -0.5cm (50th percentile)
- For fasting insulin, high, medium, and low VPA levels were associated with a corresponding reduction of:
  - -27.7 and -12.0 pmol/L (90th percentile)
  - -17.1 and -5.8 pmol/L (75th percentile)

Table 1.
Pooled meta-analytic effects for each quantile and level of VPA across WC & FI

Cardiometabolic Risk Factor	Quantile	Pooled Random Effect	(SE)	(95%CI)		P
Low Vigorous Physical Activity 2.9 (0.7) min•day^{-1}						
Waist Circumference, cm	10	0.135	(0.298)	(-0.449	0.719)	0.651
	25	-0.201	(0.164)	(-0.522	0.120)	0.220
	50	-0.548	(0.301)	(-1.138	0.042)	0.068
	75	-1.057	(0.395)	(-1.831	-0.283)	0.007
	90	-1.292	(0.727)	(-2.716	0.132)	0.075
Insulin, pmol/L	10	0.885	(1.155)	(-1.380	3.149)	0.444
	25	1.726	(0.955)	(-0.146	3.597)	0.071
	50	2.323	(1.039)	(0.286	4.360)	0.025
	75	0.511	(2.654)	(-4.690	5.713)	0.847
	90	0.133	(7.871)	(-15.295	15.560)	0.987
Moderate Vigorous Physical Activity 10.8 (2.5) min•day^{-1}						
Waist Circumference, cm	10	-0.001	(0.279)	(-0.549	0.547)	0.997
	25	-0.371	(0.231)	(-0.823	0.082)	0.109
	50	-1.027	(0.473)	(-1.954	-0.100)	0.030
	75	-2.243	(0.672)	(-3.561	-0.925)	0.001
	90	-3.139	(1.019)	(-5.137	-1.142)	0.002
Insulin, pmol/L	10	0.574	(1.073)	(-1.529	2.677)	0.593
	25	0.250	(0.941)	(-1.594	2.093)	0.790
	50	0.509	(1.221)	(-1.885	2.902)	0.677
	75	-5.788	(4.876)	(-15.345	3.769)	0.235
	90	-17.081	(8.784)	(-34.297	0.134)	0.052
High Vigorous Physical Activity 25.0 (5.2) min•day^{-1}						
Waist Circumference, cm	10	-0.292	(0.382)	(-1.041	0.456)	0.444
	25	-1.024	(0.401)	(-1.811	-0.238)	0.011
	50	-2.032	(0.652)	(-3.311	-0.753)	0.002
	75	-3.992	(0.858)	(-5.673	-2.310)	0.000
	90	-6.102	(1.285)	(-8.621	-3.583)	0.000
Insulin, pmol/L	10	-3.304	(2.115)	(-7.448	0.840)	0.118
	25	-0.993	(1.418)	(-3.771	1.785)	0.484
	50	-2.698	(1.795)	(-6.216	0.821)	0.133
	75	-12.038	(4.855)	(-21.553	-2.523)	0.013
	90	-27.722	(8.221)	(-43.836	-11.608)	0.001

Table 1.
Pooled meta-analytic effects for each quantile and level of VPA across WC & FI

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Figure 1. Distribution of waist circumference (cm) and associations with low, moderate, and high levels- of vigorous physical activity (VPA) across quantiles

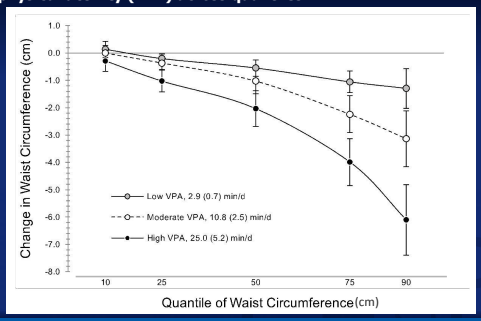
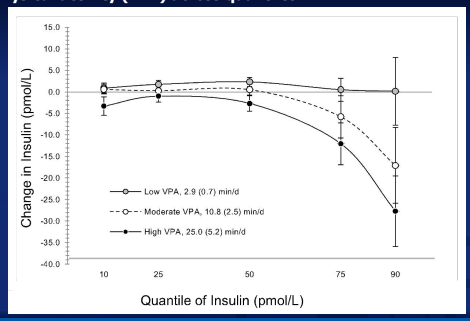


Figure 2. Distribution of fasting insulin (pmol/L) and associations with low, moderate, and high levels- of vigorous physical activity (VPA) across quantiles



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DISCUSSION

Discussion

- First study of this scope to examine VPA and biomarkers in a diverse sample of youth.
- Strengths
  - Sample size
  - Diversity of contributing studies
- Weaknesses
  - Cross sectional
  - Lack of dietary or genetic data.

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CONCLUSIONS

Conclusions

- VPA may have unique physiologic health benefits above those conveyed by MPA
- Intensity should be considered when setting policy recommendations for physical activity of youth
  - Approximately 20-25 min/d of the recommended 60 minutes of MVPA should be of a vigorous intensity
  - As little as 11 min/d my have benefit in those who need it the most
- Future intervention studies are needed to determine the modifiability of VPA and associated biomarkers.


Thank you to the Physical Activity Section for Sponsoring this session
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