

## The GOALS Study:

### The association between physical activity, cognitive performance, and academic achievement in adolescents

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### Background (I)

Task Type	Control	Exercise
Executive	~0.1	~0.7
Controlled	~0.1	~0.45
Spatial	~0.1	~0.4
Speed	~0.1	~0.3

Nature Reviews | Neuroscience  
Hillman, Erickson & Kramer, 2008

- Physical activity has a positive effect on cognitive performance in older adults

### Background (II)

- Adolescents as a group did not get much attention

- Therefore: high importance to investigate factors which may stimulate optimal brain development in adolescents

### Background (III)

- Physical activity is positively associated with cognitive performance in adults
- Little research has been done in adolescents
- Brain of adolescents is still in development
- Thus: the association between physical activity and cognitive performance is important and interesting to investigate.

### Previous studies in adolescents (I)

- Spanish adolescents, aged 13-18 years

Table I. Cognitive performance by participation in physical sports activity during leisure time in adolescents

	Model 1			Model 2		
	Yes (n = 1953)	No (n = 508)	Cohen's d (95% CI)	Yes (n = 817)	No (n = 392)	Cohen's d (95% CI)
Overall cognitive performance (0-99)	14.7 (13.0)	15.1 (13.3)	0.33 (0.22-0.42)	14.3 (11.4)	15.1 (13.3)	0.30 (0.19-0.38)
Verbal ability (0-33)	21.4 (18.5)	19.8 (16.7)	0.30 (0.19-0.39)	21.5 (17.7)	20.4 (15.8)	0.36 (0.24-0.38)
Numeric ability (0-33)	14.8 (13.2)	13.1 (11.4)	0.29 (0.19-0.39)	14.8 (11.3)	13.3 (10.8)	0.27 (0.15-0.38)
Reasoning ability (0-33)	18.8 (16.5)	17.2 (15.7)	0.28 (0.18-0.38)	18.8 (15.8)	17.7 (15.7)	0.23 (0.12-0.32)

Ruiz et al., 2010

- Sport participation during leisure time is associated with better cognitive performance

### Previous studies in adolescents (II)

Active Commuting to School (ACS)

- Non-ACS
- ACS ≤ 15min
- ACS > 15min

Boys: P = .46  
Girls: P < .001

Martinez-Gomez et al., 2010

- Active commuting to school and its duration may positively influence cognitive performance in girls

### Previous studies in adolescents (III)

- Swedish adolescents, aged 15-16 years

	Step 1	$\beta^2$	Step 2	$\beta^2$	Step 3	$\beta^2$
Girl						
Child factors						
Mother's education	16	.21	28	.19	29	
Family structure	-48	-.02	-	-.02	-	
Parental monitoring	35	.05	33			
Age	22	.12	14			
Pubertal phase	-19	-.19	-22			
Sum of school	-13	-.11	-18			
Physical factors						
Light activity	21	.19				
Moderate activity	24	.22				
Vigorous activity	15	.14				
Physical						

Kwak et al., 2009

- Vigorous physical activity is positively associated with academic achievement in girls

### Limitations previous research

- Not all studies measured physical activity objectively
- None of these studies include both cognitive performance and academic achievement
- No inclusion of other interesting variables (sleep duration, computer gaming and television viewing)
- Lack of other relevant outcomes (mood, self-esteem)
- No longitudinal perspective

### Research questions

What is the effect of :

- Physical activity
- Commuting to school
- Sleep duration
- Computer gaming and television viewing

On:

- Cognitive performance
- Academic achievement
- Mood
- Self-esteem

### Methods

- Longitudinal observational study
- 500 students, aged 12-17 years
- University preparatory education level
- Secondary schools in Zuid-Limburg

### Procedure

Before (week 0)



- Follow-up



End (week 2)



### Independent variables

- Physical activity
  - Objective (accelerometer)
  - Subjective (self-reported)
- Sleep duration
- Computer gaming
- Television viewing

### Dependent variables

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- Cognitive performance
- Academic achievement
  - Dutch, English, Mathematics
- Mood
  - CES-D self-report scale
- Self-esteem
  - Rosenberg self-esteem scale

### Covariates

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- Body Mass Index
- Alcohol consumption
- Smoking
- Socioeconomic status
- Pubertal phase
- Aerobic fitness

Thank you for your attention!

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