

# **Physical activity and good fitness improve cardiac regulation in children**

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# Associations of physical activity, sedentary time, and cardiorespiratory fitness with heart rate variability in 6- to 9-year-old children: the PANIC study

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Got one minute?

Got interested?

Got sleeping problems?









## WHY STUDY?

    
Physical activity = Healthy heart  
But how?  
Changes in heart rate variability?

## SUBJECTS

 **377 children**  
**49% boys**  
**6–9 years old**

## WHAT? MEASUREMENTS HOW?

**Heart rate variability**  **Electrocardiogram**   
**Physical activity**  **Wearable sensor**   
**Sedentary time**  **Bicycle test**   
**Fitness**  **Bicycle test**   
**+ Labs, adiposity, waist, blood pressure**

## Why we studied

Physical activity and good fitness  
= good for your heart  
BUT WHY?  
Is it because we lose weight and get better  
cholesterol and glucose labs?  
**COULD ONE EXPLANATION IS...**  
Change in regulation of heart and vasculature  
(so called autonomic nervous system)

## Study population and setting

- 377 children, 49% boys
- 6–9 years old
- 98% prepubertal
- Measured one time (cross-sectional study)

## Study questions

**COULD WE SEE HEALTHIER AUTONOMIC NERVOUS SYSTEM IN THOSE WHO:**

- Are more physically active?
- Spend less time sedentary?
- Have better fitness?
- In different combinations of above?
- ...is it because of those other risk factors...?

## Background

Globally, cardiovascular diseases cause remarkable individual, public health, and economic burden. The beneficial effects of physical activity in those diseases are well studied but still the mechanisms are not completely understood. Alterations in autonomic nervous system has been proposed as one mechanism in addition to traditional risk factors.

## Study purpose

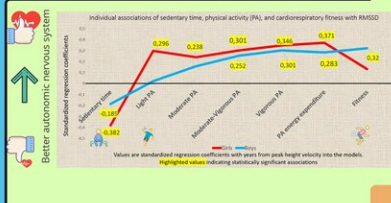
Purpose of the study was to search if there was an associations with autonomic nervous system and physical activity, sedentary time and cardiorespiratory fitness, including traditional cardiometabolic risk factors in the analysis.

## Methods

**IS HIGHER HEART RATE VARIABILITY (5-min resting eeg) ASSOCIATED WITH:**

- Minutes in active & sedentary level, calculated from data measured with wearable monitor (heart rate & movement sensor)
- Higher intensity level in bicycle test (maximal achieved workload per lean mass)
- Above assessed in same model and grouped into medians
- Included MetScore into analysis (=cholesterol, glucose, blood pressure and waist circumference)

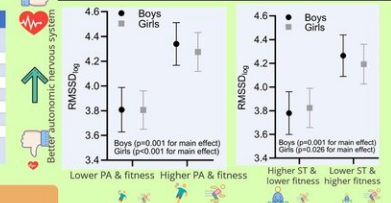
## RESULTS



MetScore adjusted associations of sedentary time, physical activity (PA), and cardiorespiratory fitness with RMSSD




	Stand. regression coefficient	p
<b>Boys</b>		
Sedentary time	0.117	0.333
PA energy expenditure	0.259	0.046
Fitness	0.270	0.001
<b>Girls</b>		
Sedentary time	-0.279	0.022
PA energy expenditure	0.120	0.334
Fitness	0.084	0.267

Sedentary time, PA energy expenditure, and fitness were entered simultaneously with years from peak height velocity, body fat percentage, and cardiometabolic risk score into the models.



## CONCLUSIONS

### INDEPENDENTLY OF ALL MEASUREMENTS:

-  **Better fitness**
-  **Lower sedentary time**
- COMBINED ASSOCIATIONS:**
-  **Better fitness + higher physical activity or lower sedentary time**

Healthier autonomic nervous system

Higher sedentary time and lower physical activity and poorer fitness were associated with poorer cardiac autonomic nervous system function in children. Poorer fitness in boys and higher sedentary time in girls were the strongest correlates of poorer cardiac autonomic nervous system function. Beneficial effects of an active lifestyle go beyond traditional cardiovascular risk factors.

**Get moving!**



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[www.panicstudy.fi](http://www.panicstudy.fi)

The Physical Activity and Nutrition  
in Children (PANIC) Study



Open access:

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A recent Finnish study showed that more physically active and fit children have better cardiac regulation than less active and fit children. The study also showed that cardiac regulation was better especially in boys with better aerobic fitness and in girls with lower levels of sedentary time. The results, based on the Physical Activity and Nutrition (PANIC) Study conducted at the University of Eastern Finland, were published in the *European Journal of Applied Physiology*.

Cardiovascular diseases cause a remarkable individual, public health, and economic burden globally. Cardiovascular diseases have their origins in childhood, and [physical activity](#) has been found to prevent or postpone the development of these diseases. However, the mechanisms for the beneficial effects of physical activity are not completely understood. Improvements in cardiac regulation by the [autonomic nervous system](#) in response to physical activity have been proposed as one of these mechanisms. Nevertheless, there are few studies linking physical activity and aerobic fitness with cardiac autonomic regulation in children.

Altogether 377 children aged six to nine years participated in the study. Cardiac autonomic regulation was assessed by [heart rate variability](#) from electrocardiograms, physical activity and sedentary time by a combined heart rate and movement sensor, and aerobic fitness by a maximal exercise test on a bicycle ergometer. The data were adjusted for maturation, body fat percentage, waist circumference, fasting plasma glucose, plasma lipids, and blood pressure.

The researchers found that higher sedentary time and lower levels of physical activity and aerobic fitness were associated with poorer cardiac autonomic nervous system function in children. They also observed that particularly high levels of vigorous physical activity had a [strong relationship](#) to better cardiac autonomic nervous system function. Lower aerobic fitness in boys and higher sedentary time in girls were the strongest correlates of poorer cardiac autonomic nervous system

function. These associations were independent of other cardiometabolic risk factors.

"Our study provides novel and valuable information as we were able to study the role of not only physical activity but also sedentary time, aerobic fitness, and other cardiometabolic risk factors as correlates of cardiac autonomic nervous system function in children," says Dr. Aapo Veijalainen, MD, Ph.D., from University of Eastern Finland.

We can conclude that the beneficial effects of a physically [active lifestyle](#) and good [aerobic fitness](#) go beyond traditional cardiovascular risk factors and all measures that get children to move must be supported.

**More information:** Aapo Veijalainen et al. Associations of physical activity, sedentary time, and cardiorespiratory fitness with heart rate variability in 6- to 9-year-old children: the PANIC study, *European Journal of Applied Physiology* (2019). [DOI: 10.1007/s00421-019-04231-5](#)

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