

Compositional analysis of physical activity and sedentary time in relation to cardiometabolic risk in preschool children

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Introduction

- Participating in recommended amounts of physical activity (PA) and minimising sedentary time during childhood are important for health and development¹⁻⁴
- There is increasing interest in the importance of patterns of accumulation (i.e., different length 'bouts') of PA and sedentary time for children's cardiometabolic health,⁵ and in the overall daily time-use composition of behaviours⁶

Objective

To examine associations between the PA and sedentary time composition, including short and long bouts, and cardiometabolic risk factors in 4-year-old children

Methods

- Barwon Infant Study 4-year review data were analysed
- Children wore GT3X ActiGraph accelerometers for 7 consecutive days; short and long sedentary time and light-, moderate-, and vigorous-intensity PA bouts were classified as ≤ 1 -min and >1 -min
- Cardiometabolic measures: body mass index (BMI), percent body fat, triceps and subscapular skinfolds, blood pressure, heart rate, pulse wave velocity, and aortic and carotid intima-media thickness (aIMT and cIMT)
- A composition of eight components was constructed using compositional analysis
- Linear mixed models examined associations between the composition and cardiometabolic risk factors, adjusting for sex, age, maternal education, total energy intake, and birth weight z-score

Results

- 603 (56%) of the 1074 children in the inception birth cohort returned accelerometry data as part of the 4 year review; data from 482 children met wear criterion; these data were used to form daily time-use compositions
- Children (48% girls) were on average 4.2 years of age and 63% of mothers had a tertiary education
- Compositional means of the proportions of time spent in short and long bouts of sedentary time and light-, moderate- and vigorous-intensity PA are presented in Table 1

Table 1. Compositional means of the proportion of time spent in short and long bouts of PA and sedentary time

	Sedentary time		Light-intensity PA		Moderate-intensity PA		Vigorous-intensity PA	
	Short	Long	Short	Long	Short	Long	Short	Long
Compositional mean, % of wear time	12.0	36.0	20.1	18.2	8.6	1.2	2.9	0.9

Adjusted regression models showed:

- A higher ratio of **long vs. short light-intensity PA bouts** was associated with:
 - ↑ BMI z-score ($\beta=1.7$, $SE=0.8$, $p=0.04$)
 - ↑ percent body fat ($\beta=10.7$, $SE=3.7$, $p=0.004$)
 - ↑ triceps z-score ($\beta=1.9$, $SE=0.9$, $p=0.04$)
- A higher ratio of **long vs. short moderate-intensity PA bouts** was associated with:
 - ↓ BMI z-score ($\beta=-1.0$, $SE=0.5$, $p=0.03$)
 - ↓ percent body fat ($\beta=-4.6$, $SE=1.9$, $p=0.02$)
- A higher ratio of **total volume of moderate-intensity vs. vigorous-intensity PA** was associated with:
 - ↑ percent body fat ($\beta=4.1$, $SE=1.6$, $p=0.01$)
 - ↑ triceps z-score ($\beta=1.1$, $SE=0.4$, $p=0.01$)

Discussion

- Higher ratio of long vs. short bouts of light-intensity PA positively associated with measures of adiposity: potentially a result of breaking up sedentary time; changes in posture (i.e. breaking up sitting time) are associated with increased energy expenditure in preschool children⁷
- Higher ratio of long vs. short bouts of moderate-intensity PA inversely associated with adiposity, suggesting that encouraging young children to engage in moderate-intensity PA for longer periods of time (rather than sporadic PA) may be important for health
- Total volume of moderate-intensity relative to vigorous-intensity PA appeared to be less beneficial for adiposity, suggesting that higher intensity PA should be encouraged

Conclusions

- Accumulating light-intensity PA in short bursts, moderate-intensity PA in long bursts, and accumulating a high total volume of vigorous-intensity PA may be beneficial for adiposity markers
- These results highlight the importance of breaking up sedentary time and promoting sustained, higher intensity physical activity in young children

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