

# HIGHER LEVELS OF CARDIORESPIRATORY FITNESS ARE SIGNIFICANTLY RELATED WITH LESS OBESITY RISK IN ADOLESCENTS

Machado-Rodrigues A.M.,<sup>1,2</sup>, Padez C.<sup>1</sup>, Rodrigues D.<sup>1</sup>, Silva M.<sup>1</sup>, Fernandes R.<sup>3</sup>, Mota J.<sup>4</sup>

<sup>1</sup> Research Centre for Anthropology and Health, University of Coimbra, Portugal;

<sup>2</sup> High School of Education, Polytechnic Institute of Viseu, Portugal.

<sup>3</sup> Universidade Estadual de São Paulo, Presidente Prudente, Brasil;

<sup>4</sup> Faculdade de Desporto, Universidade do Porto, Portugal.

## Background

The increased prevalence of obesity in youth is a major medical and public health problem globally. On the other hand, the potential for CRF to influence obesity risk in youth independently of behavioral and social factors has not been extensively explored. Therefore, the purpose of this study was to analyze the association between cardiorespiratory fitness (CRF) and the risk of obesity in a sample of Portuguese adolescents.

## Methods

The sample comprised 254 adolescents (114 boys, 140 girls) aged 13-16 years, from regions of the Portuguese Midlands. Height, weight, and BMI were assessed. CRF was measured using the PACER test. An uniaxial GT1M accelerometer was used to obtain five consecutive days of physically activity (PA) and sedentary behavior. Logistic regression analyses were used to analyze the afore-mentioned associations, with adjustments for several potential confounders (e.g. age, sedentary behavior, parental education).

## Results

Based on the BMI, weight status of the sample was as follows: 79% normal weight, 16% overweight, 5% obese (boys); 76% normal weight, 19% overweight, 5% obese (girls).

After controlling for confounders, unfit adolescents were more likely to have higher adiposity than their unfit counterparts, for both males and females. The final regression model also showed that girls classified as unfit were 59% more likely to be inactive than their fit counterparts.

**Table 1.** Descriptive statistics and results of ANCOVAs (chronological age as co-variable) testing the effect of sex on body size, sedentary behaviour, physical activity and aerobic endurance.

Variables	Boys (n=114) Mean ± SD	Girls (n=140) Mean ± SD
<b>Anthropometry:</b>		
Chronological age, years	14.3±1.1	14.3±1.0
Height, cm	165.1±8.9	158.2±8.4 **
Weight, Kg	56.6±11.6	53.5±10.0 **
WC, cm	78.5±8.2	77.2±7.7
<b>Physical activity/Sedentary behaviour:</b>		
MT (week days), min/day	888.9±51.4	890.4±58.7
MT (weekend), min/day	789.8±77.8	783.2±75.1
MT (total of 5 days), min/day	849.2±47.3	847.4±49.5
SED <sup>a</sup> (week days), min/day	725.7±81.0	743.4±80.7 **
SED <sup>a</sup> (weekend), min/day	670.8±84.5	678.2±80.2
SED <sup>a</sup> (total of 5 days), min/day	703.7±58.1	716.4±55.7 **
PA <sup>b</sup> (week days), counts/min/day	510.2±167.5	434.8±124.4 **
PA <sup>b</sup> (weekend), counts/min/day	391.0±161.8	348.7±136.4 *
PA <sup>b</sup> (total of 5 days), counts/min/day	462.5±142.3	389.5±115.7 **
MVPA <sup>c</sup> (week days), min/day	91.3±38.9	78.2±29.3 **
MVPA <sup>c</sup> (weekend), min/day	53.0±35.8	43.2±28.1 *
MVPA <sup>c</sup> (total of 5 days), min/day	75.9±31.3	62.9±28.1 **
<b>Physical fitness:</b>		
CRF, #	70.4±22.9	41.0±15.5 **

\* P<0.05; \*\* P<0.01; <sup>a</sup>Adjusted for measured time; <sup>b</sup>Log-transformed values were used in the analysis; MT (measured time); WC (Waist Circumference); PA (Physical Activity); SED (minutes spent sedentary); MVPA (Moderate-to-Vigorous Physical Activity). SD (standard-deviation).

**Table 2.** The association between obesity risk and cardiorespiratory fitness controlling for biological and social variables in Portuguese children.

Group	n	Model <sup>a</sup>	Obesity Risk				
			B	S.E.	e <sup>b</sup>	95% C.I.	p
Males	114	1	-0.002	0.001	0.99	0.998 to 0.999	0.002
		2	-0.002	0.001	0.99	0.997 to 0.999	0.001
		3	-0.002	0.001	0.99	0.997 to 0.999	0.001
		4	-0.002	0.001	0.99	0.997 to 0.999	0.002
Females	140	1	-0.003	0.001	0.998	0.995 to 0.998	0.001
		2	-0.003	0.001	0.997	0.995 to 0.998	0.001
		3	-0.004	0.001	0.996	0.994 to 0.998	0.001
		4	-0.004	0.001	0.996	0.994 to 0.998	0.001

<sup>a</sup> Model 1 = Cardiorespiratory Fitness; Model 2 = model 1 + chronological age; Model 3 = model 2 + Sedentary Behaviour; Model 4 = model 3 + maternal education, paternal education.

## References

- [1] Lee S. & Arslanian S. (2018). *Journal of Adolescent Health*. 2018 Oct 31. [doi: 10.1016/j.jadohealth.2018.08.024]
- [2] Machado-Rodrigues, et al. (2011). *Annals of Human Biology*. Vol. 38(4): 479-484.
- [3] Machado-Rodrigues, et al. (2014). *American Journal of Human Biology*. 26(5):670-5.
- [4] Valente H et al., (2011). *Public Health Nutrition* 14(1):127-132.
- [5] Yu HJ, et al. (2018). *J. Pediatr*. 2018 Sep; 200:150-154.

## Conclusion

Results of the present study indicate that unfit adolescents were more likely to have higher adiposity than their fit peers. Therefore, future research is claimed among adolescents from different geographic contexts to try to clarify recent findings of less studied communities.

**Keywords:** Adiposity, Cardiorespiratory Fitness, Adolescence, Cardiac health