

CHANGES IN SPANISH ADOLESCENTS' CARDIORESPIRATORY ENDURANCE IN A PERIOD OF 20 YEARS (1998-2018).

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INTRODUCTION

Physical fitness is a measure of the body's ability to perform physical activity and exercise, thus providing a valuable indicator of health (Tomkinson, Carver, et al., 2017). Cardiorespiratory endurance (CRE), also known as cardiovascular fitness, cardiorespiratory fitness or aerobic fitness, is an essential component for physical fitness and good health in general.

Researchers have shown that physical conditions and fitness work during childhood and adolescence are determining factors for good health both current and future. Furthermore, there is evidence pointing to the long-term effect of adolescent physical activity on adult morbidity and mortality, along with growing evidence that physical inactivity during adolescence carries over into adulthood. However, recent research studies reported that many adolescents fail to hit the recommended levels of weekly physical activity, and they show, in addition, a worrying and progressive decline in the physical fitness levels of the current generation of adolescents when compared to teenagers of previous decades (Ferrari, Matsudo, & Fisberg, 2015; Suris, Michaud, Chossis, & Jeannin, 2006).

Although numerous studies have analyzed the sports habits of the Spanish population (García-Ferrando & Llopis, 2011), there is a paucity of quantitative data on the evolution of fitness conditions, and specifically CRE evolution, in Spanish adolescents.

OBJECTIVES

The aim of the present study was to track the trends and changes in cardiorespiratory endurance among Spanish adolescents over a 20 year period (1998-2018).

METHODS

The study was designed as a retrospective cross-sectional analysis of school tests. CRE was assessed using the 20-m Shuttle Run (20m SRT) (Léger, Mercier, Gadoury, & Lambert, 1988) included in the EUROFIT battery.

Parameters of 1,798 adolescents (945 boys and 823 girls), aged 15 and 16 years, were collected from a database containing the results of 20mSRT conducted by physical teachers as part of two schools' physical education program from 1998 to 2018.

To compare the results over time, the sample has been disaggregated by sex and divided into four groups, corresponding to consecutive periods of five years each. Thus, Group 1 covers the 1999-2003 courses; Group 2, the 2004-2008; Group 3, the 2009-2013, and Group 4 the 2014-2018. Descriptive statistics were used for demographics, and groups were compared by analysis of variance (ANOVA) with two factors (gender and promotion). Statistical significance was set at $p < 0.05$. Statistical analyses were performed by using SPSS.20 for Mac (SPSS Inc., Chicago, IL, USA).

RESULTS

Results showed a statistically significant decrease in cardiorespiratory endurance performance, in both sexes ($p < 0.05$).

Boys' groups reported a higher performance (number of stages) in the 1999-2003 promotion (10.48 ± 2.19) as compared to 2009-2013 and 2014-2018 promotions (9.44 ± 2.12 $p = 0.000$; 9.76 ± 1.97 $p = 0.001$, respectively). The 2004-2008 promotion reported also higher performance (10.34 ± 2.29) regarding the 2009-2013 and 2014-2018 promotions (9.44 ± 2.12 , $p = 0.000$; 9.76 ± 1.97 , $p = 0.048$, respectively), showing a decline in the CRE physical capacity.

Girls achieved the highest performance in the 1999-2003 promotion: 6.93 ± 1.75 stages, and decline in performance was statistically significant when compared to 2009-2013 and 2014-2018 promotions (5.93 ± 1.68 , $p = 0.000$; 6.30 ± 1.82 , $p = 0.009$, respectively).

Table 1. Descriptive analysis of results in 20-m Shuttle Run test over a 20-year period. The data are shown as mean \pm SD.

	Group 1: 1999-2003	Group 2: 2004-2008	Group 3: 2009-2013	Group 4: 2014-2018
Boys	10.48 \pm 2.19	10.34 \pm 2.29	9.44 \pm 2.12 *†	9.76 \pm 1.97 *†
Girls	6.93 \pm 1.75	6.48 \pm 1.82	5.93 \pm 1.68 §‡	6.30 \pm 1.82 §

* Statistically significant compared to Group 1

† Statistically significant compared to Group 2

§ Statistically significant compared to Group 1

‡ Statistically significant compared to Group 2

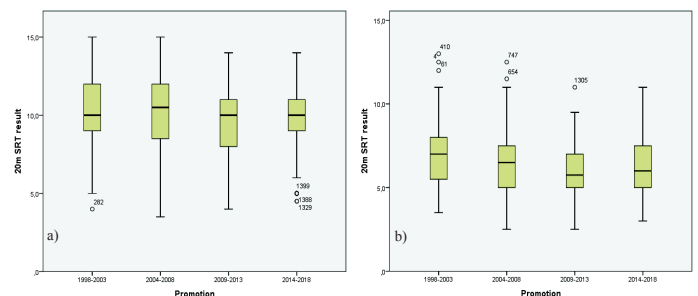


Figure 1. Evolution of 20 m SRT results over the last 20 years. a) boys, b) girls

CONCLUSIONS

The present study reports a significant decline of CRE in adolescents aged between 15 and 16 years old, for both genders, over a 20-year period.

These results agree with those previously reported, showing a general and progressive decrease in adolescents' aerobic capacity compared to teenagers of previous decades (Tomkinson, Lang, et al., 2017). Issues like physical inactivity and sedentary lifestyle of our societies, the increased levels of obesity and overweight, social habits and leisure activities shifted to more "screen time" with social media and new technologies, might explain the decline in cardiorespiratory endurance in Spanish adolescents.

The association between child and adolescent physical activity level and cardiovascular health in adulthood recommends that physical fitness of Spanish adolescents should be encouraged to acquire physical activity habits. Schools and educational youth programs must include effective physical education programs in order to improve adolescents' health and well-being. Besides this, schools may promote healthy habits through increasing physical education hours in the school curriculum, which encourages all students to be physically active.

The results of the present study are of relevance to physical educators, health care professionals, policy makers, and researchers interested in paediatric health.

REFERENCES

- Ferrari, G. L. D. M., Matsudo, V. K. R., & Fisberg, M. (2015). Changes in physical fitness and nutritional status of schoolchildren in a period of 30 years (1980-2010). *Revista Paulista de Pediatria*, 33(4), 415-422. doi: 10.1016/j.rppede.2015.03.001
- García-Ferrando, M., & Llopis, R. (2011). *Encuesta sobre los hábitos deportivos en España 2010. CSD (Consejo Superior de Deportes)*. Madrid: CSD (Consejo Superior de Deportes), CIS (Centro de Investigaciones Sociológicas).
- Léger, L. A., Mercier, D., Gadoury, C., & Lambert, J. (1988). The multistage 20 metre shuttle run test for aerobic fitness. *Journal of Sports Sciences*, 6(2), 93-101. doi: 10.1080/026440418808729800
- Suris, J.-C., Michaud, P.-A., Chossis, I., & Jeannin, A. (2006). Towards a Sedentary Society: Trends in Adolescent Sport Practice in Switzerland (1993-2002). *Journal of Adolescent Health*, 39(1), 132-134. doi: 10.1016/j.jadohealth.2005.09.001
- Tomkinson, G. R., Carver, K. D., Atkinson, F., Daniell, N. D., Lewis, L. K., Fitzgerald, J. S., ... Ortega, F. B. (2017). European normative values for physical fitness in children and adolescents aged 9-17 years: results from 2 779 165 Eurofit performances representing 30 countries. *British Journal of Sports Medicine*, 52(22), 1445-14563. doi: 10.1136/bjsports-2017-098253
- Tomkinson, G. R., Lang, J. J., Tremblay, M. S., Dale, M., Leblanc, A. G., Belanger, K., ... Léger, L. (2017). International normative 20 m shuttle run values from 1 142 026 children and youth representing 50 countries. *British Journal of Sports Medicine*, 51(21), 1545-1554. doi: 10.1136/bjsports-2016-095987