# LONGITUDINAL DIFFERENCES OF PHYSICAL ACTIVITY AND ADIPOSITY IN ADOLESCENTS: A 2-YEAR FOLLOW-UP

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## Abstract

It is commonly believed that boys are more physically active than girls, which could affect body composition changes during adolescence. One major point not always considered or controlled is the maturational differences between boys and girls of similar chronological age. So, it remains to be determined the importance of physical activity (PA) behaviors adjusted by sex and maturation on body composition modifications. This study complement the published results by evaluating the effects of gender, sexual maturation level on PA and body composition changes.

**PURPOSE:** To explore PA and adiposity alterations in Spanish students during adolescence.

**METHODS:** Sixty-eight healthy adolescents were followed-up during 2-year (32 girls and 36 boys). A PA score was estimated by Physical Activity Questionnaire (PAQ-A). Adiposity was assessed by anthropometric measurements, BMI and fat mass percent (FMP) were calculated using classical equation, and waist circumference (WC) as abdominal adiposity marker. Tanner's maturation stages were evaluated. Three assessments were performed: September 2011, 2012 and 2013 (S1, S2, and S3, respectively). Repeated measures were carried out between three moments for all variables and adjusted by maturation level and sex.

**RESULTS:** Significant differences for FMP were found between S1 and S2 (22.30±8.22 vs. 21.15±7.73, P<0.05); a significant interaction with sex was observed (P<0.05), but not for maturation. Regarding PA, S2 was significantly higher than S3 (2.68±0.68 vs. 2.23±0.72, P<0.001). An interaction between PA and maturation was statically significant (P<0.05).

**CONCLUSION:** The main finding of this follow-up was a reduction in PA after S2 period without changes in adiposity. In opposite, a reduction of FMP was only significant between S1 and S2, while PA was not modified. Our results suggest that body composition and PA changes observed during adolescence are not parallel. Moreover, the interaction analysis highlighted that maturation affect PA behavior, but not sex.

## Introduction

Adolescent obesity has increased dramatically in several countries in recent decades; however, the contribution of physical activity (PA) level to adolescent adiposity requires clarification.

It is presumed that PA level declines during the lifespan, particularly in adolescence (Sallis, 2000; Thompson, Baxter-Jones, Mirwald, & Bailey, 2003) The literature supports the contention that boys are more active than girls at all ages during the circumpubertal years when PA is measured using a variety of self-report tools (Dumith, Gigante, Domingues, & Kohl, 2011).

One major point not always considered or controlled is the maturational differences between boys and girls of similar chronological age. So, it remains to be determined the importance of PA behaviors adjusted by sex and maturation on body composition modifications.

## Purpose

The aim of the present study was to explore PA and adiposity alterations in Spanish students during adolescence.

## Methods

**Sample.** Sixty-eight healthy adolescents (age: 14.3 ±2.3 yr, weight: 52.9 ±12.2 Kg, height: 159.6 ± 11.6 cm, and BMI: 20.6 ± 3.3 kg/m$^2$, FMP: 22.8% ±7.9%) were included in this study (32 girls and 36 boys).

***Body composition.*** Anthropometric measurements, including height and body mass, were performed by International Society for the Advancement of Kinanthropometry (ISAK) certified personnel, according to the ISAK standards for anthropometric assessment (ISAK, 2001). Fat mass percent (FMP) was calculated using Slaughter´s equation (Slaughter et al., 1988). Maturation stages were assessed by photographic models proposed by Tanner (Tanner & Whitehouse, 1982).

***PA assessment.*** A PA questionnaire was administered one time per year: September 2011, 2012 and 2013 (S1, S2, and S3, respectively). The PA questionnaire for adolescence (PAQ-A) consist of nine items designed to provide a measure of a child's general PA level during the school year. Each item is scored on a 5-point scale, with higher scores indicating higher levels of activity. The mean of these items forms a composite activity score.

***Statistical analysis.*** Statistical analysis performed using SPSS software version 21.0. Values are reported as means standard deviation (SD). A repeated measures analysis were carried out between three moments for all variables and adjusted by maturation level and sex. A level of significance of $P < 0.05$ was used.

## Results

Significant differences for FMP were found between S1 and S2 (22.30±8.22 vs. 21.15±7.73, P<0.05); a significant interaction with sex was observed (P<0.05), but not for maturation. Regarding PA, S2 was significantly higher than S3 (2.68±0.68 vs. 2.23±0.72, P<0.001). An interaction between PA and maturation was statically significant (P<0.05).

Table 1. Characteristics of participants at baseline and years 1 and 2 by sex

| | S1* | | S2 | | S3 | |
|---|---|---|---|---|---|---|
| | Girls** | Boys | Girls | Boys | Girls | Boys |
| **Age (years)** | 13.9±1.9 | 14.6±2.6 | 14.7±1.7 | 15.1±2.4 | 15.7±1.7 | 16.1±2.4 |
| **Weight (Kg)** | 49.9±11.2 | 55.6±12.5 | 52.5±11.9 | 59.6±12.8 | 53.8±1.1 | 61.1±10.3 |
| **Height (cm)** | 156.8±7.4 | 162.1±14 | 159.5±6.9 | 166.2±11.7 | 160.9±5.9 | 168.6±10.9 |
| **BMI (Kg/m2)** | 20.2±3.6 | 21±3.1 | 20.5±3.6 | 21.4±3.1 | 20.7±3.5 | 21.4±2.5 |
| **Tanner (≤3/4/5)** | 11/18/3 | 16/16/4 | - | - | 1/20/11 | 11/17/8 |

*S1, S2, S3 (September 2011, 2012 and 2013 respectively).
**Girls n=32; Boys n=36.

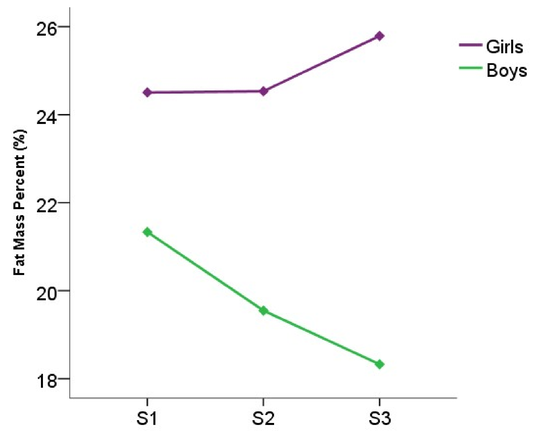


Figure 1. Changes in fat mass percent at years 1 and 2 compared with baseline.

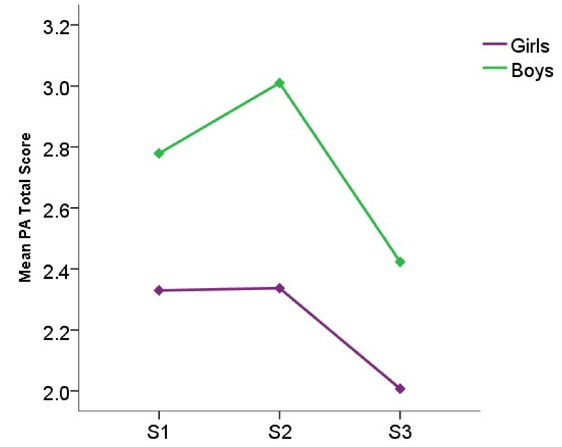


Figure 2. Changes in PA at years 1 and 2 compared with baseline.

## Summary & Conclusions

- The main finding of this follow-up was a reduction in PA after S2 period without changes in adiposity. Conversely, a reduction of FMP was only significant between S1 and S2, while PA was not modified.
- Ours results are in accordance with findings in the literature supporting a decline of PA during adolescence (Dumith, Gigante, Domingues, & Kohl, 2011). However, differences between boys and girls in the pattern of PA was not confirmed.
- In summary, body composition and PA changes observed were not parallel. These data seem to suggest that PA patterns were influenced by maturation but not for sex.

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