

Fitness as a Mediator Between the 24-Hour Movement Guidelines and Mathematical Fluency in Adolescents

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Purpose: Lack of physical activity (PA), prolonged screen time, and insufficient sleep present major health challenges for adolescents, not only because they are associated with metabolic and cardiovascular diseases, also because of their effects on academic performance. This study examines the association between different adherence to 24-hour movement guidelines and mathematical fluency in adolescents with cardiorespiratory (CRF) and muscular fitness (MF) as mediators.

Methods: A total of 522 adolescents (12.46 ± 0.73 years; 48.6% female) from 11 Spanish secondary schools participated in the study. Adolescents wore wrist-mounted accelerometers for eight consecutive days to assess adherence to the guidelines for (1) PA and (2) sleep. Compliance with the (3) recreational screen time guideline was assessed using self-reported data on time spent using different devices. CRF and MF were assessed through ALPHA fitness test battery and mathematical fluency using test number 6 of the Woodcock protocol. Participants were categorised into three groups: (1) no behaviours met, (2) one behaviour met, and (3) two or more behaviours met. One-way ANOVA with post hoc test compared mean differences between groups. Mediation analysis was conducted to examine the mediating role of CRF and MF in the relationship between adherence to 24-hour movement guidelines and mathematical fluency.

Results: A 7.4% of adolescents met two or more guidelines, while 38% met one and 54.6% met no guideline. The mediation analysis showed a positive and significant indirect effect ($p < 0.05$) of adherence to guidelines on mathematical fluency via CRF, but not significant effect via MF ($p > 0.05$). This indirect effect was observed in participants who met one behaviour compared to those who met none ($\beta = 0.0388$; 95% confidence interval (CI) = 0.0041, 0.0832) and was stronger when comparing those who met two or more guidelines to those who met none ($\beta = 0.0987$; 95% CI = 0.0257, 0.1960).

Conclusion: Promoting CRF through adherence to daily movement guidelines may enhance mathematical fluency, suggesting that PA policies could serve as a tool to improve cognitive and educational outcomes in youth.

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