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Sedentary Time, Sleep, and Physical Activity: A Structural Equation Model of Health-Related Quality of Life in Saudi Children and Young People

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Purpose: Health-related quality of life (HRQoL) is shaped by behavioural, physiological, and contextual factors. In Saudi Arabia, socio-cultural norms and environmental factors may uniquely shape how children and young people (CYP) engage in physical activity (PA) and experience its impact. This study aimed to 1) explore associations between PA, sedentary time (ST), sleep, and HRQoL; 2) examine whether body size and physical fitness mediate the PA–HRQoL relationship; and 3) assess the influence of biological maturity on these variables.

Methods: A sample of 404 Saudi CYP (202 males; 12.2 ± 2.4 years) wore wrist-mounted accelerometers (*Axivity AX3*) for seven consecutive days to assess PA, ST, and sleep. Physical fitness was estimated via the 20 m shuttle run test, and body size via body mass index and waist circumference. HRQoL was measured using the validated Arabic KIDSCREEN-27. Age-to-peak-height-velocity served as a marker of biological maturity. Partial Least Squares Structural Equation Modelling (PLS-SEM) with 5,000-sample bootstrapping tested hypothesised associations.

Results: ST was negatively associated with PA ($\beta = -1.02$, $p < 0.001$) and sleep ($\beta = -0.53$, $p < 0.001$). Shorter sleep duration was also associated with lower PA ($\beta = -0.61$, $p < 0.001$). PA was associated with lower body size ($\beta = -0.20$, $p = 0.003$), which predicted reduced fitness ($\beta = -0.30$, $p < 0.001$) and lower physical wellbeing (HRQoL subscale; $\beta = -0.28$, $p < 0.001$). No direct PA–HRQoL link was observed. Physical fitness was not significantly associated with HRQoL ($\beta = 0.065$, $p = 0.150$). A significant indirect association between PA and HRQoL emerged through body size alone. Maturity was negatively associated with PA ($\beta = -0.14$, $p < 0.001$) and physical fitness ($\beta = -0.19$, $p = 0.002$) but not body size ($\beta = -0.085$, $p = 0.202$).

Conclusion: Findings highlight intermediary pathways linking ST, sleep, and PA with HRQoL in Saudi CYP. The absence of a direct PA–HRQoL association reinforces body size as a key mediator. Greater biological maturity may be associated with lower PA and fitness, possibly due to psychosocial or behavioural factors. These results emphasise the importance of culturally tailored, age-sensitive interventions to support PA and wellbeing. Longitudinal research is warranted to clarify these relationships and inform evidence-based strategies to improve quality of life among children and young people.

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