

Beyond fitness: a community exercise intervention boosts physical and psychological outcomes in vulnerable children and adolescents

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ABSTRACT

This study examined the impact of a community sport program on physical fitness and socio-emotional skills in socially vulnerable Portuguese adolescents. Seventy-four participants (6–17 years) took part in a once-weekly, multi-sport intervention embedded in their school context. A repeated-measures design assessed participants at baseline, mid-intervention, and post-intervention. Physical fitness was assessed using the FITescola test battery, and socio-emotional skills using the Organisation for Economic Co-operation and Development Social and Emotional Skills Questionnaire. Linear mixed models revealed significant improvements in core muscular endurance (abdominal curls, $p = .028$, $d = .32$) and running speed ($p = .001$, $d = .42$). Socio-emotional gains were observed in resilience ($p = .017$), stress resistance ($p = .008$), confidence ($p < .001$), and empathy ($p = .025$), with small-to-moderate effect sizes. These findings suggest that a low-frequency, long-term community program nested in participants' educational ecology can promote both physical and psychological health in this population. Despite limitations — including a quasi-experimental design and once-weekly frequency — this study offers preliminary evidence for settings-based interventions to reduce health inequities. Future randomised controlled trials should establish causality and explore underlying mechanisms.

KEYWORDS: sports; physical exercise; socially vulnerable youth; youth development.

INTRODUCTION

Adolescence is a critical stage for physical, psychological, and social development, during which regular physical exercise is considered a key characteristic of overall health and well-being (Brown et al., 2017). However, an adolescent's ability to engage in and benefit from such health-promoting behaviours is shaped by individual, social, and environmental determinants (Sallis & Glanz, 2006). Among these, socioeconomic context is a particularly powerful upstream factor. Young people who grow up in vulnerable contexts face reduced access to sports facilities, higher levels of stress, and poorer health indicators (Dyremyhr et al., 2014). Consequently, effectively promoting health in this population requires strategies that directly

address these barriers, highlighting the importance of community programmes that promote active lifestyles alongside emotional and behavioural development. The role of exercise professionals is particularly relevant, as their behaviour can significantly influence young people's motivation and enjoyment (Braga-Pereira et al., 2024; Braga-Pereira et al., 2025a; 2025b). The broader benefits of structured exercise have been demonstrated across different populations, including frail older individuals (Furtado et al., 2023) and older women during social isolation (Cezário et al., 2022).

Contemporary theoretical models, such as Self-Determination Theory, suggest that interventions that combine physical activity with social support can elicit integrated

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improvements when they satisfy the basic psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2024). Similarly, ecological models emphasise that interventions conducted in settings where young people live and spend time are particularly effective (McLeroy et al., 1988). The settings-based approach is a hallmark of contemporary health promotion, encouraged by the World Health Organisation (Potvin & Jones, 2011) and supported by a wide body of evidence (Kokko et al., 2013). Literature shows that community exercise programmes can improve strength, cardiorespiratory fitness, and psychological parameters such as self-esteem and motivation (Warburton & Bredin, 2017). Such interventions have been successfully implemented in underserved youth populations, including after-school programmes and community sports initiatives (Kokko et al., 2013). However, most studies use restricted samples, non-vulnerable populations, or interventions that are poorly adapted to real-world contexts (Cortis et al., 2017). The integration of objective and subjective monitoring tools, as demonstrated in professional football (Lourenço et al., 2023), could enhance understanding of exercise-induced adaptations in vulnerable youth. Furthermore, research examining the physical and psychological effects of exercise programmes specifically aimed at socially disadvantaged adolescents, particularly in the Portuguese context, remains scarce (Milton et al., 2021). There are also limitations regarding short intervention durations and poor representativeness of community settings (O'Brien & Finch, 2014). Thus, the current study sought to evaluate the effects of a community-based physical exercise intervention on physical fitness and psychological indicators in socially vulnerable adolescents. Specifically, we analysed changes in physical strength, cardiovascular fitness, self-esteem, motivation, well-being, and emotional perceptions after the intervention. This study aims to contribute to an integrated understanding of the benefits of exercise in vulnerable populations and to support the creation of more effective, evidence-based community programmes.

METHODS

Participants

This trial involved seventy-four children and adolescents from disadvantaged settings. Eligibility criteria included: enrolment at participating schools, no injuries/illnesses that interfered with physical activities, and attendance at at least 75% of sessions. Written consent was obtained from all participants and their legal guardians. This longitudinal quasi-experimental study received ethical approval from the

Instituto Politécnico da Maia Research Centre (07/2025) and was conducted in accordance with the Declaration of Helsinki and the Convention of Oviedo.

Measures and procedures

The intervention ran from November to June, with one-hour sessions once per week. Several sports were introduced as an extension of physical education classes. A repeated-measures design was adopted, with assessments conducted at three critical junctures: November (baseline), March (mid-intervention), and June (post-intervention), with approximately four months between the first two and three months between the last two (see Figure 1).

The FITescola, a standardised national protocol for Portuguese youth, was administered. Body mass and height were measured using a digital column scale and a stadiometer (SECA 213) to calculate BMI. Cardiorespiratory fitness was assessed via the 20-meter shuttle run (PACER) test. Lower-body explosive strength was evaluated through the standing long jump. Upper-body strength was assessed by the push-up test (or modified version for younger participants). Change-of-direction and speed were measured using the 4 × 10-meter shuttle run. Flexibility was assessed with a sit-and-reach box (Lafayette Instrument 01285A). A familiarisation session preceded formal testing, and all tests were conducted under the supervision of a qualified physical education teacher following official FITescola methodology. The Portuguese version (Castro et al., 2023) of the Organisation for Economic

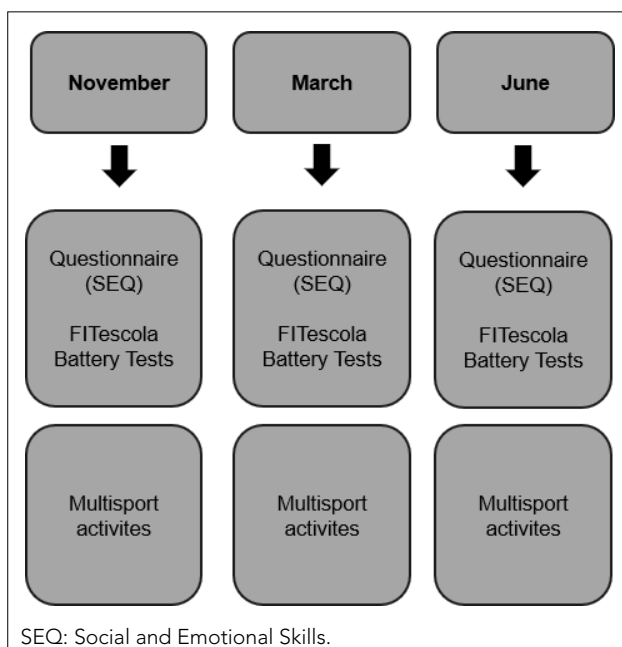


Figure 1. Study Timeline.

Co-operation and Development (OECD) Survey on Social and Emotional Skills (SSES) was used, an instrument developed and validated by the OECD for international assessment (OECD, 2021), measuring six key areas: Optimism, Resilience, Persistence, Stress Resistance, Trust, and Empathy. Each area includes eight items rated on a five-point Likert scale. Paper-and-pencil questionnaires were completed in a private room under researcher supervision, with sessions lasting 10–15 minutes.

Statistical analysis

Statistical analyses were conducted using R Studio. Data normality was assessed using the Shapiro-Wilk test, and homogeneity of variances using Levene's test. Linear

mixed models were performed with time as a fixed factor, participant ID as a random factor, and each outcome as a dependent variable. Post-hoc tests were adjusted using Bonferroni correction. Effect sizes (Cohen's d) were interpreted as: $d < .20$: trivial; $.20 \leq d < .50$: small; $.50 \leq d < .80$: moderate; $d \geq .80$: large. Statistical significance was set at $p < .05$.

RESULTS

Participants had a mean age of 12.7 ± 2.9 years (32.4% female, 67.6% male). A total of 62 participants attended the first assessment, 60 the second, and 57 the third (Figure 2). Linear mixed models revealed significant improvements in

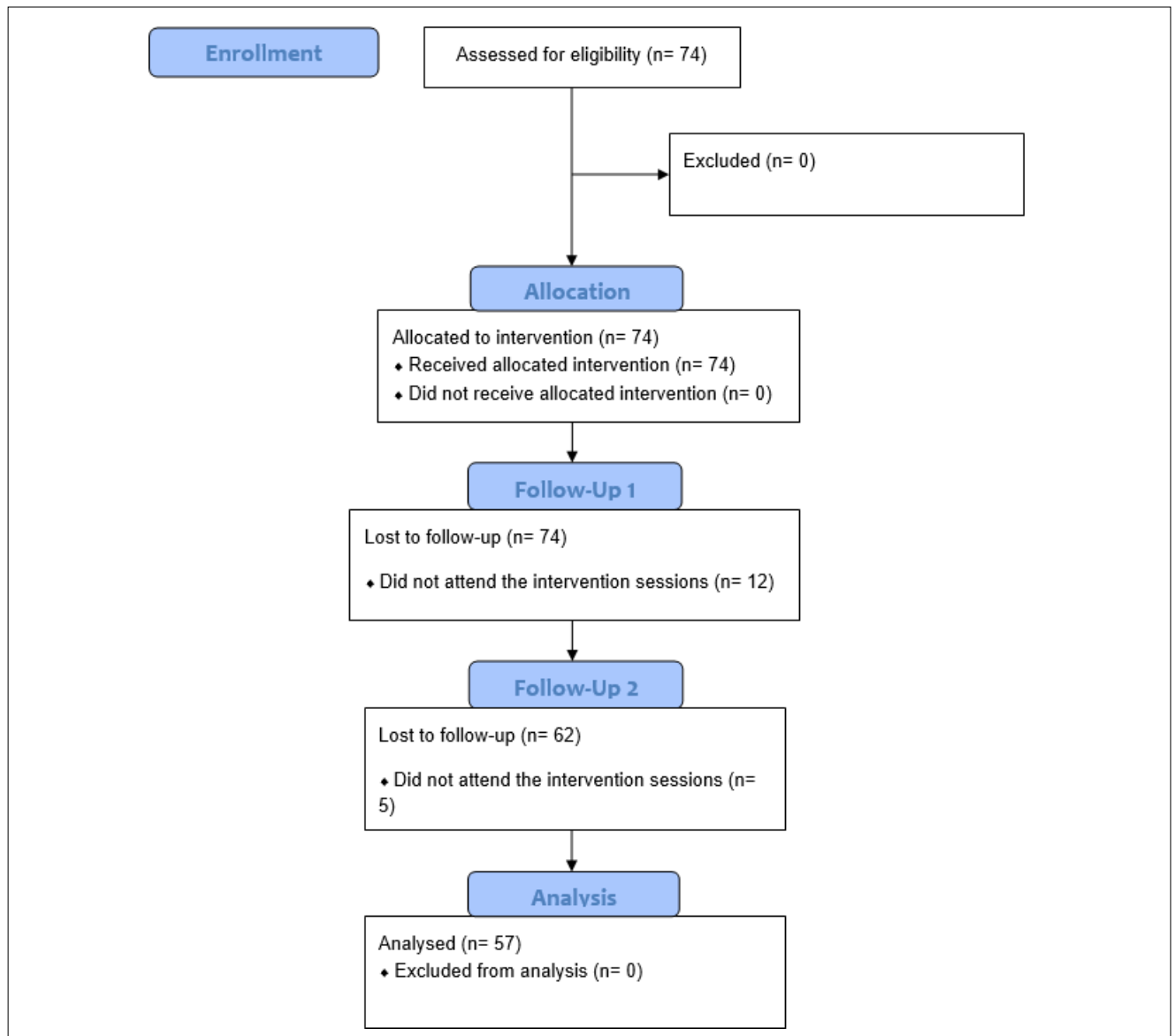


Figure 2. Consolidated Standards of Reporting Trials (CONSORT) diagram.

abdominal curls ($p = .028$) and running speed ($p = .001$). No significant effects were observed for change of direction ($p = .075$), push-ups ($p = .101$), or shoulder flexibility ($p = .207$). Post-hoc comparisons showed a significant increase in abdominal curls from baseline to post-intervention ($p = .025$, $d = .63$). For running speed, significant improvements were observed from baseline to mid-intervention ($p = .001$, $d = .84$) and from baseline to post-intervention ($p = .021$, $d = -.63$).

Concerning socio-emotional skills, significant improvements were observed for resilience ($p = .017$), stress resistance ($p = .008$), confidence ($p < .001$), and empathy ($p = .025$). No significant effects were detected for optimism ($p = .062$) or persistence ($p = .070$). Post-hoc analyses revealed that resilience improved from baseline to post-intervention ($p = .021$, $d = .47$). Stress resistance improved from baseline to mid-intervention ($p = .025$, $d = .46$) and from mid- to post-intervention ($p = .019$, $d = .48$). Confidence increased from mid- to post-intervention ($p < .001$, $d = .66$), as did empathy ($p = .037$, $d = .44$) (Table 1).

DISCUSSION

The current study investigated the impacts of a community-based sports program, run in conjunction with the school environment, on the physical and socio-emotional

competencies of adolescents from vulnerable socioeconomic groups. The results suggest that a long-term, low-frequency (once-weekly) intervention led to positive changes in both physical and socio-emotional outcomes, providing initial support for its viability and multifaceted effectiveness. From a physical standpoint, the improvements in core muscular endurance (abdominal curls) and running velocity are consistent with expected training adaptations. The gains in running speed, already evident at mid-intervention, likely reflect neuromuscular and coordinative adaptations to the multi-sport activities (Warburton & Bredin, 2017). The absence of significant changes in upper-limb strength (push-ups) and shoulder flexibility is likely attributable to the program's low frequency. Upper-body strength gains typically require sufficient mechanical load and progressive overload, thresholds that may not have been met with only one weekly session in adolescents without complementary resistance training (Behringer et al., 2010). Similarly, flexibility improvements demand consistent stretching routines — ideally three to five times weekly — to produce lasting changes (Decoster et al., 2005). Thus, while effective for certain outcomes, the program's low-frequency design inherently limited adaptations that require more frequent stimuli. The psychosocial results are particularly noteworthy. Improvements in resilience, stress resistance, confidence, and empathy align with theoretical frameworks

Table 1. Physical fitness and psychosocial outcomes across assessment time points. Score ranges for psychosocial skills: 1–5 (based on the SEQ questionnaire).

Outcome	M1 (mean ± SD)	M2 (mean ± SD)	M3 (mean ± SD)	p-value (M1 vs M2)	d (M1 vs M2)	p-value (M2 vs M3)	d (M2 vs M3)	p-value (M1 vs M3)	d (M1 vs M3)
Physical Fitness									
Shuttle Run (laps)	39.4 ± 25.6	38.1 ± 26.5	39.7 ± 28.3	1.000	-.05	1.000	-.30	.876	-.32
Abdominal Curls (n)	26.3 ± 24.6	32.7 ± 29.5	34.5 ± 38.6	.217	-.42	.812	-.27	.025	-.63
Change of direction (s)	12.4 ± 1.61	11.9 ± 2.04	11.9 ± 1.39	.175	.43	1.000	.07	.120	.47
Sprint (s)	3.65 ± .48	3.35 ± .40	3.42 ± .41	.001	.84	1.000	-.16	.021	.64
Shoulder Flexibility (right, cm)	1.38 ± .49	1.33 ± .47	1.36 ± .49	.310	.39	1.000	-.10	.739	.28
Shoulder Flexibility (left, cm)	1.48 ± .51	1.40 ± .5	1.39 ± .50	.373	.36	1.000	.03	.370	.36
Arm Flexibility (n)	6.81 ± 9.47	7.05 ± 9.39	7.30 ± 8.83	1.000	-.05	.130	-.54	.254	-.45
Psychosocial Skills									
Optimism	3.99 ± .70	3.24 ± 1.41	3.08 ± 1.69	1.000	.14	.388	.26	.062	.40
Resilience	3.62 ± .65	3.18 ± 1.02	2.85 ± 1.39	1.000	.14	.094	.37	.021	.47
Persistence	3.67 ± .81	3.51 ± 1.14	3.14 ± 1.42	1.000	.04	.183	.33	.115	.36
Stress Resistance	2.58 ± .59	3.01 ± 1.05	2.61 ± 1.25	.025	-.46	.019	.48	1.000	.01
Empathy	3.15 ± .71	3.42 ± 1.09	3.08 ± 1.38	.095	-.37	.037	.44	1.000	.06
Confidence	3.75 ± .87	3.82 ± 1.17	3.21 ± 1.53	.296	-.28	< .001	.66	.092	.37

such as Self-Determination Theory, which posits that experiences of autonomy, competence, and relatedness enhance well-being (Standage & Ryan, 2020). The program's communal and gamified environment likely provided such need-supportive conditions. Notably, significant changes in confidence and empathy emerged only between mid- and post-intervention, with no improvements from baseline to mid-intervention. This delayed effect may reflect the time required for psychosocial traits to develop, as psychological constructs such as confidence and empathy often require sustained exposure to need-supportive environments before becoming internalised (Ryan & Deci, 2017). The initial weeks likely involved establishing trust and group cohesion — prerequisite conditions for subsequent gains. This pattern aligns with ecological perspectives that emphasise the need for prolonged exposure to achieve lasting changes in complex psychosocial attributes (Golden & Earp, 2012). Nonetheless, this study presents limitations. The quasi-experimental design and absence of a control group limit causal inference. The once-weekly frequency and limited sample size — while sufficient to detect some significant results — were underpowered for variables such as optimism and persistence, where only near-significant trends emerged. These constraints likely contributed to the predominantly small effect sizes (ranging from .22 to .42) and the selective reporting of physical outcomes. Despite these limitations, this study fills an important gap by offering a unique combination of physical and psychosocial outcomes in a real-world community setting, focusing on Portuguese disadvantaged youth through a long-term longitudinal design. The results suggest that a low-frequency, long-term school-based intervention may be a feasible and effective tool for integrated health promotion in vulnerable populations, with important implications for health equity and the use of sports interventions to address disparities.

CONCLUSION

This study provides preliminary evidence that a school-based community sports program may improve physical fitness and social-emotional skills in adolescents from vulnerable backgrounds. However, due to the quasi-experimental design and absence of a control group, causal conclusions cannot be drawn. Future research should employ randomised controlled designs with larger samples, include objective physical activity measures, and investigate the mechanisms (e.g., group cohesion, coach leadership) through which such settings exert their psychosocial effects.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

João Francisco Ferreira — Conceptualisation; Investigation; Methodology; Writing – original draft; Writing – review & editing.

Filipe Maia — Data curation; Formal analysis; Software; Visualisation; Writing – review & editing.

Ricardo Maia Ferreira — Investigation; Resources; Writing – review & editing.

António Rodrigues Sampaio — Supervision; Validation; Writing – review & editing.

Joana Carreiro — Investigation; Data curation; Writing – review & editing.

Daniel Duarte — Conceptualisation; Funding acquisition; Project administration; Supervision; Validation; Writing – review & editing.

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