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REVIEW

Traditional Fitness Gym Training Effects on Cardiovascular Parameters, Body Composition, and Posture in Adolescents: A 15-Year Review

Genti Pano[1]; Andis Bogdani[2]; Anduela Lile[2]; Anri Kruja

Department of Biomedical and Health Sciences, Faculty of Rehabilitation Sciences, Sports University of Tirana (Albania)

2 Department of Sport Management, Faculty of Physical Activity and Recreation, Sports University of Tirana (Albania)

Corresponding author: Genti Pano. gpano@ust.edu.al

Abstract

Adolescence represents a critical developmental period for the maturation of cardiovascular, metabolic, and musculoskeletal systems. Declining physical activity and increasing sedentary behaviour during this stage are associated with cardiometabolic risk, body composition changes, and postural deviations. Traditional fitness gym training combining aerobic and resistance exercise performed on machines in supervised indoor environments may simultaneously target these health domains. This review aimed to identify and synthesize evidence on the effects of gym-based aerobic and resistance exercise on cardiovascular parameters, body composition, and posture in adolescents. Materials and Methods: A structured literature search was conducted in PubMed, PubMed Central (PMC), and HINARI databases to identify intervention studies published between 2009 and 2025. Eligible studies included adolescents aged 10 to 19 years engaged in supervised gym or indoor facility programs using aerobic and/or resistance equipment. Outcomes included cardiorespiratory fitness, cardiometabolic indicators, body composition, and postural assessments. Randomized controlled trials, non-randomized controlled trials, and quasi-experimental studies were included. Results: A total of ten analytical units fulfilled the inclusion criteria. Interventions generally spanned 8 to 22 weeks, with 2 to 4 sessions weekly. Combined aerobic and resistance training was associated with improvements in cardiorespiratory fitness (VO_2peak), reductions in body fat, and increases in lean mass. Resistance-focused interventions were associated with improvements in blood pressure and body composition. Three studies evaluated postural outcomes, suggesting potential improvements in trunk endurance and postural alignment. Conclusions: Supervised gym-based aerobic and resistance training is associated with improvements in cardiovascular fitness and body composition in adolescents and may contribute to postural improvements, although current evidence for posture remains limited. These findings suggest that structured gym-based programs may represent a useful strategy for adolescent health promotion; however, further high-quality research is needed.

Keywords: adolescents, gym-based training, resistance training, aerobic exercise, cardiovascular fitness, body composition, posture.

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1. Introduction

Adolescence represents a critical developmental phase for establishing cardiovascular, metabolic, and musculoskeletal health trajectories that extend into adulthood. Cardiorespiratory fitness during youth is a strong predictor of future cardiovascular morbidity and mortality (Ortega et al., 2008). However, global trends indicate a decline in physical activity levels alongside an increase in sedentary behaviors among adolescents, contributing to the rising prevalence of cardiometabolic risk factors, unfavorable body composition, and postural abnormalities (WHO, 2020). These patterns highlight the need for structured and effective exercise interventions targeting multiple health domains in this population.

Traditional fitness gym environments provide a controlled and adaptable setting in which adolescents can engage in both aerobic and resistance training using machines or free weights. Aerobic exercise, such as treadmill or cycle ergometer training, enhances cardiovascular function through central and peripheral adaptations, including increased stroke volume and improved oxygen transport capacity. In contrast, resistance training promotes skeletal muscle hypertrophy, metabolic regulation, and musculoskeletal stability (Faigenbaum et al., 2013). Evidence suggests that combining aerobic and resistance training may lead to significant improvements in cardiorespiratory fitness and reductions in adiposity among adolescents (Mendonça et al., 2022; Sigal et al., 2014).

During adolescence, body composition is particularly responsive to resistance-based exercise due to rapid hormonal and musculoskeletal development. Supervised strength training in gym settings has been shown to increase lean body mass and reduce fat mass, contributing to improved metabolic profiles and a lower risk of cardiovascular disease and type 2 diabetes (Santos et al., 2020). Moreover, multimodal training approaches that integrate different exercise types appear to be more effective in improving overall fitness and body composition compared to single-modality interventions (Cohen et al., 2021).

In addition to cardiovascular and metabolic benefits, resistance-based gym training may positively influence postural health. Strengthening the trunk and scapular stabilizing muscles enhances neuromuscular control and spinal alignment, thereby reducing common postural deviations in adolescents, such as forward head posture and shoulder protraction (Ruivo et al., 2017). Although posture is less frequently assessed in exercise research, existing evidence suggests that structured resistance and flexibility programs can improve musculoskeletal alignment during this critical developmental stage.

Despite these documented benefits, most research on adolescent exercise interventions has been conducted in school or sports-specific settings rather than in conventional fitness facilities. Consequently, the specific effects of supervised, machine-based indoor gym training on cardiovascular parameters, body composition, and postural outcomes in adolescents have not been comprehensively synthesized. Furthermore, the limited availability of randomized controlled trials in healthy adolescent populations necessitates the inclusion of non-randomized and quasi-

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experimental studies to better reflect real-world training environments. Therefore, the purpose of this review is to identify and synthesize existing evidence on the effects of supervised conventional fitness facility training incorporating aerobic and resistance machine-based exercises on cardiovascular parameters, body composition, and postural outcomes in adolescent populations.

2. Materials and Methods

This study was conducted as a structured narrative review with a systematic search strategy examining the effects of supervised gym-based aerobic and resistance training on cardiovascular parameters, body composition, and posture in adolescents.

Search strategy

A comprehensive literature search was performed across electronic databases including PubMed, PubMed Central (PMC), and HINARI to identify relevant studies published between January 2009 and January 2025. Additional records were screened from reference lists of eligible articles to ensure completeness. Although supplementary sources such as journal publisher platforms were consulted for full-text access, they were not used as primary search databases.

The search strategy combined keywords and Boolean operators related to the population, intervention, and outcomes of interest. Search terms included "adolescent" OR "youth" AND "resistance training" OR "strength training" OR "aerobic training" OR "gym-based" OR "machine-based exercise" AND "cardiovascular" OR "VO_2peak" OR "blood pressure" OR "body composition" OR "posture." The search strategy was adapted as necessary for each database.

Study selection process

All identified records were imported and screened in a two-stage process. First, titles and abstracts were reviewed to exclude clearly irrelevant studies. Subsequently, full-text articles were assessed for eligibility based on the predefined inclusion criteria. The screening process was conducted independently by two reviewers, and any discrepancies were resolved through discussion and consensus.

Eligibility criteria

Studies were considered eligible if they included adolescent participants aged between 10 and 19 years and investigated supervised exercise interventions conducted in gym or indoor fitness facilities. Eligible interventions included aerobic training, resistance training, or a combination of both, performed using machines or structured equipment. Studies were required to report at least one of the following outcomes: cardiovascular parameters (such as VO_2peak or blood pressure), body composition, or postural measures. Both randomized controlled trials and non-randomized intervention studies with pre–post or controlled designs were included. Only full-text articles published in peer-reviewed journals and written in English were considered. Traditional fitness gym training was defined as supervised exercise performed in indoor fitness or school-based facilities using resistance machines and/or aerobic equipment (e.g., treadmill, cycle ergometer). Studies including minor complementary components (e.g., plyometric or bodyweight exercises) were included only if the primary intervention consisted of supervised machine-based resistance or aerobic training.

Data extraction

Data from the included studies were systematically extracted using a standardized approach. Extracted information included study design, sample characteristics, intervention type and duration, training frequency, and reported outcomes related to cardiovascular health, body composition, and posture. The extraction process was performed independently by the reviewers to ensure accuracy.

Quality assessment and risk of bias

The methodological quality of the included studies was evaluated using appropriate criteria based on study design. Randomized controlled trials were assessed for potential sources of bias including randomization procedures, allocation concealment, and outcome reporting, while non-randomized studies were evaluated for selection bias, intervention consistency, and outcome measurement reliability. Given the heterogeneity of study designs and outcome measures, a qualitative assessment of methodological quality was conducted rather than a quantitative scoring system.

Data synthesis

Due to the variability in study designs, intervention protocols, and outcome measures, a meta-analysis was not feasible. Therefore, a narrative synthesis approach was used to summarize the findings. Results were grouped according to the primary outcomes of interest, including cardiovascular parameters, body composition, and postural adaptations. In cases where multiple studies shared highly similar intervention characteristics and outcomes, they were grouped and analyzed as a single analytical unit to facilitate synthesis. The review protocol was not registered (e.g., PROSPERO), which represents a potential limitation.

3. Results

Study selection and characteristics

The database search identified a total of 120 records. After the removal of 20 duplicate records, 100 studies remained for title and abstract screening. Of these, 75 were excluded based on irrelevance to the topic.

A total of 25 full-text articles were assessed for eligibility. Fifteen studies were excluded due to not meeting the inclusion criteria, including non-gym-based interventions, absence of relevant outcomes, or inappropriate population.

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Finally, 10 studies met the inclusion criteria and were included in the qualitative synthesis (Figure 1).

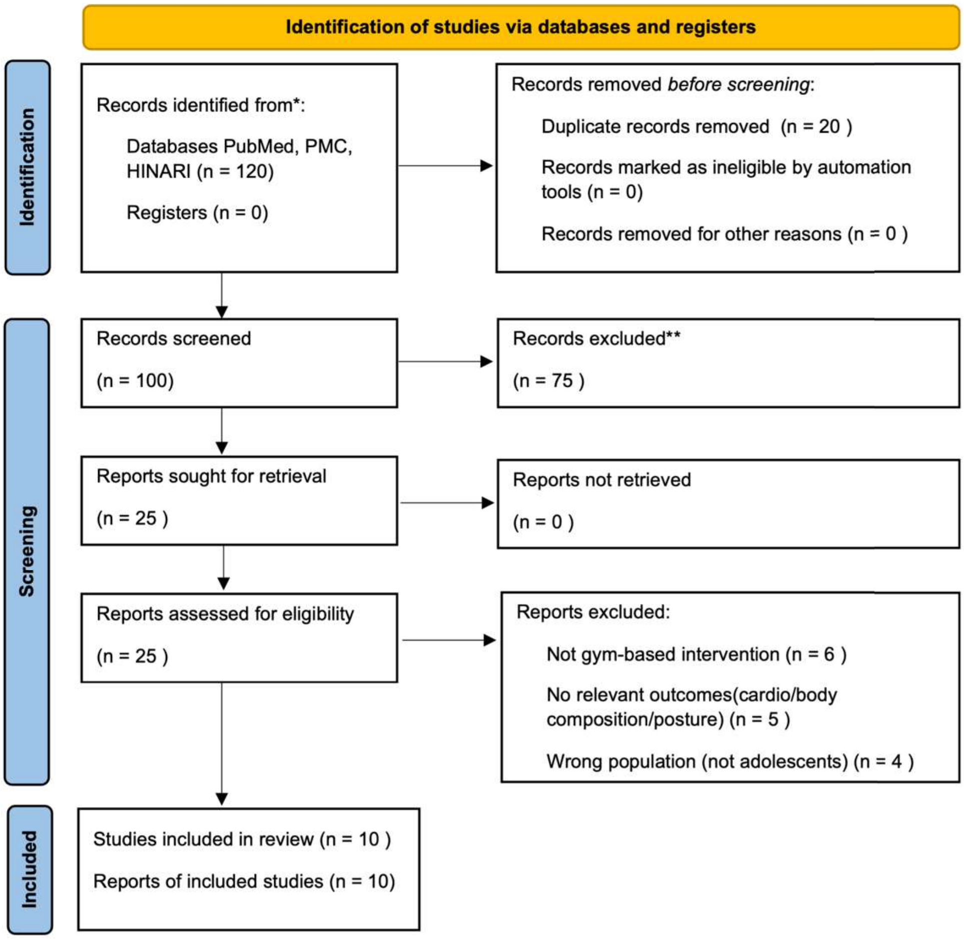

Figure 1. PRISMA flow diagram of study selection

Study characteristics

A total of 10 analytical units were included in this review. One category represents a synthesis of multiple school-based resistance training studies conducted between 2009 and 2015, which were grouped due to their methodological and intervention similarities.

The sample sizes ranged from 40 to 96 participants, with ages between 12 and 17 years. Six studies implemented combined aerobic and resistance training in school gyms or fitness centers, while four focused primarily on resistance-based programs. Intervention durations ranged from 8 to 22 weeks, with training frequencies of 2 to 4 sessions per week.

Cardiorespiratory fitness consistently improved in studies involving combined training protocols (Tjønna et al., 2009; Sigal et al., 2014; Cohen et al., 2021; Mendonça et al., 2022), with reported increases in VO_2peak and reductions in blood pressure. Resistance-focused interventions demonstrated significant improvements in body composition, including reductions in fat mass and increases in lean mass (Lubans et al., 2012; Santos et al., 2020; Wan et al., 2025).

Additionally, resistance-machine training programs conducted in school settings showed consistent improvements in muscular strength and reductions in adiposity. Three studies assessed postural outcomes, all reporting improvements in trunk endurance and reductions in forward head posture or shoulder protraction (Ruivo et al., 2017; Cohen et al., 2021; Mendonça et al., 2022), although these findings are based on a limited number of studies.

Overall, the evidence suggests that supervised gym-based aerobic and resistance training contributes to improvements in cardiovascular fitness, body composition, and postural stability in adolescents. All of these details are summarized in Table 1.

Table 1. Summary of Included Gym-Based Training Studies in Adolescents (2009–2025)

Authors	Year	Sample (age)	Design	Intervention	Duration	Outcomes
Tjønna et al.	2009	51 overweight (14–16 y)	RCT	Aerobic interval + resistance	12 weeks, 3 sessions/week	↑VO_2peak, ↓BP, ↓fat %, ↑insulin sensitivity
School-based resistance training programs (multiple studies)	2010-2015	30–70 (12–17 y)	Pre–post	Resistance machines (school gyms)	8–12 weeks	↑strength, ↓fat mass
Lubans et al.	2012	60 (13–15 y)	Quasi-experimental	Resistance machines	8 weeks, 2 sessions/week	↓fat %, ↑lean mass
Sigal et al. (HEARTY trial)	2014	96 (13–17 y)	RCT	Aerobic vs resistance vs combined training	22 weeks, 4 sessions/week	↑VO_2peak, ↓BP, ↓fat %, ↓waist circumference
Ruivo et al.	2017	45 (14–16 y)	Quasi-experimental	Resistance training + trunk/scapular exercises	12 weeks, 2 sessions/week	↓forward head posture, ↑trunk endurance
Santos et al.	2020	52 (13–16 y)	RCT	Resistance machines	12 weeks, 2–3 sessions/week	↓SBP, ↓fat %, ↑lean mass
Cohen et al. (SIMAC trial)	2021	56 (14–16 y)	RCT	Combined aerobic and resistance training vs PE	16 weeks, 3 sessions/week	↑VO_2peak, ↑lean mass, ↑trunk endurance
Mendonça et al.	2022	48 (13–16 y)	RCT	Aerobic + resistance machines	12 weeks, 2 sessions/week	↑VO_2peak, ↓fat %, ↑lean mass

Wan et al.	2025	40 girls (12–15 y)	RCT	Resistance + plyometric training	12 weeks, 2–3 sessions /week	↑lean mass, ↓fat %, ↑strength

Notes. Abbreviations: RCT = randomized controlled trial; BP = blood pressure; SBP = systolic blood pressure; VO_2peak = peak oxygen uptake; PE = physical education. Symbols: ↑ indicates a significant increase or improvement; ↓ indicates a significant decrease or reduction. The category "School-based resistance training programs (multiple studies)" represents four individual studies (Faigenbaum et al., 2010; Granacher et al., 2011; Santos et al., 2012; Lubans et al., 2012), which were grouped and analyzed as a single analytical unit due to similarities in intervention design, population, and outcomes.

The included studies demonstrate a consistent pattern of positive adaptations following supervised gym-based training interventions in adolescents. Despite variations in study design, intervention duration, and training protocols, most studies reported improvements in cardiovascular fitness, body composition, and, where assessed, postural outcomes. Combined aerobic and resistance training interventions appeared to yield the most comprehensive benefits, particularly in terms of VO_2peak and cardiometabolic markers. Resistance-focused programs were especially effective in improving body composition by increasing lean mass and reducing fat mass.

Notably, school-based resistance training interventions showed comparable effectiveness to structured gym-based programs, suggesting that supervised machine-based training can be successfully implemented in both educational and fitness facility settings. Although fewer studies evaluated postural outcomes, available evidence indicates that targeted resistance training may contribute to improvements in trunk stability and postural alignment.

Discussion

This review synthesized 15 years of evidence examining the effects of supervised traditional fitness-facility training characterized as structured aerobic and resistance exercises conducted on machines in indoor gym settings on cardiovascular health, body composition, and postural outcomes in healthy adolescents. Randomized controlled trials, quasi-experimental studies, and controlled pre–post designs generally indicate that gym-based training improves cardiorespiratory fitness, resting cardiovascular parameters, and body composition, while emerging evidence suggests potential postural adaptations (Tjønna et al., 2009; Faigenbaum et al., 2010; Sigal et al., 2014).

The most consistent finding was an improvement in cardiorespiratory fitness, often assessed by VO_2peak or shuttle-run performance. Improvements were observed in both machine-based aerobic training (e.g., treadmill or cycle ergometer) and combined aerobic–resistance programs relative to control groups (Ortega et al., 2008; Cohen et al., 2021). Similar patterns were observed in school-based resistance-training interventions; however, aerobic adaptations tended to be more pronounced in programs incorporating higher-intensity components (Lubans et al., 2012; Santos et al., 2020). These findings are consistent with known physiological adaptations to endurance training during adolescence.

Resistance-training interventions were also associated with improvements in cardiometabolic markers, including reductions in resting blood pressure and improvements in body composition. Evidence suggests that increases in skeletal muscle mass may contribute to improved metabolic regulation and vascular function (Faigenbaum et al., 2013; Ortega et al., 2008). Combined aerobic and resistance training approaches appeared to provide broader benefits across multiple outcomes compared to single-modality interventions (Sigal et al., 2014; Cohen et al., 2021).

Body composition outcomes were relatively consistent across studies, with resistance-based training associated with increases in lean mass and reductions in fat mass. Interventions lasting at least 12 weeks and conducted 2–3 times per week appeared to be associated with more pronounced effects, suggesting a potential dose–response relationship (Tjønna et al., 2009; Santos et al., 2020; Wan et al., 2025).

Fewer studies examined postural outcomes; however, some improvements in spinal alignment, trunk stability, and shoulder positioning were reported following resistance training programs targeting core and scapular musculature (Ruivo et al., 2017; Mendonça et al., 2022). These findings should be interpreted with caution, as they are based on a limited number of studies and heterogeneous assessment methods. It is possible that improvements in neuromuscular control and reductions in adiposity contribute indirectly to postural adaptations.

Overall, the available evidence suggests potential effectiveness of supervised gym-based training for adolescents across multiple health domains, although findings should be interpreted with caution due to study heterogeneity and methodological limitations.

Limitations

This review has several limitations that should be acknowledged. First, the number of included studies was relatively small, and the interventions varied considerably in terms of duration, frequency, and training modalities, which limits comparability across studies. Second, outcome measures were heterogeneous, particularly for cardiovascular and postural assessments, reducing the ability to draw consistent conclusions. Third, only a limited number of studies evaluated postural outcomes, and these findings should therefore be considered preliminary. Additionally, most studies lacked long-term follow-up, making it difficult to assess the sustainability of observed benefits into adulthood. The absence of a formal quantitative risk-of-bias assessment and the lack of protocol registration may also affect the methodological robustness of the review. Finally, the possibility of publication bias cannot be excluded.

Conclusion

This review suggests that supervised traditional gym-based training using aerobic and resistance equipment in indoor fitness settings may provide beneficial effects on cardiovascular fitness and body composition in adolescents. Resistance-based interventions appear to be associated with increases in lean mass and reductions in fat mass, while combined training approaches may offer broader cardiometabolic benefits.

Evidence related to postural outcomes remains limited; however, preliminary findings indicate that targeted resistance training may contribute to improvements in trunk stability and postural alignment. These findings should be interpreted with caution due to the small number of available studies.

Overall, current evidence tentatively supports the inclusion of supervised gym-based training as a component of adolescent health promotion programs. Nevertheless, further high-quality randomized controlled trials using standardized outcome measures and long-term follow-up are needed to strengthen the evidence base. Future research should prioritize the use of standardized and validated postural assessment tools to strengthen the evidence base in this area.

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