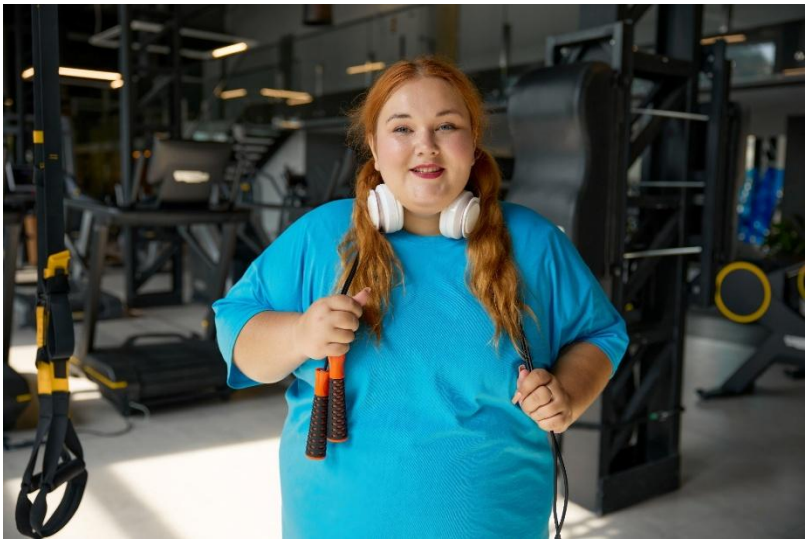
In Adolescents Physical Fitness, Weight Status and Cardiovascular Changes following School-based HIIT

Researchers investigated whether baseline weight status and cardiorespiratory fitness (CRF) were associated with changes in cardiovascular health, body composition, and physical performance following an 8-week school-based exercise intervention.

The research was conducted by scientists from the Department of Biological Principles of Physical Activity at Wroclaw University of Health and Sport Sciences in Poland.



Study

The researchers conducted an exploratory secondary analysis of an 8-week school-based cluster-randomized controlled trial involving adolescents from a secondary school in Wrocław, Poland. The analysis included 98 15-year-old participants who completed baseline and post-intervention assessments in the plyometric HIIT group. The secondary analysis did not include the original trial's control group and did not have a prespecified primary outcome.

The participants were divided into four groups based on age- and sex-specific body mass index (BMI) thresholds and sex-specific CRF thresholds: non-overweight with high CRF, non-overweight with low CRF, overweight with high CRF, and overweight with low CRF.

The intervention was incorporated into regular physical education lessons twice weekly. Each session included a 10-minute warm-up, followed by 20 seconds of high-intensity exercise and 10 seconds of recovery. Training volume increased progressively from four rounds in the first two weeks to six rounds in weeks three and four, and eight rounds during the final four weeks.

The Tabata-style exercise program involved burpees, high knees, squat jumps, and mountain climbers and required no specialized equipment.

Assessments included estimated maximal oxygen uptake (VO2max), body fat percentage, vertical jump height, standing broad jump distance, systolic blood pressure (SBP), diastolic blood pressure, mean arterial pressure, resting heart rate, and heart rate reserve. VO2max, an indicator of cardiorespiratory fitness, was estimated using a 20-meter shuttle run test.

The researchers used statistical analyses to compare outcomes between groups after accounting for baseline measurements, determine whether individual improvements reached predefined thresholds, and identify potential predictors of these changes.

Findings

The participants were distributed across four categories: Non-overweight with high CRF (27 participants), non-overweight with low CRF (49), overweight with high CRF (9), and overweight with low CRF (13). None of the participants met the criteria for obesity.

After eight weeks, most participants initially classified as having high CRF retained this classification. More than 88% of adolescents in both high-fitness groups remained in this category. Among participants with initially low CRF, 16.3% of those without overweight transitioned to high CRF, whereas none of those with overweight achieved this transition.

Mean estimated VO2max increased in each group. The improvements ranged from 1.17 to 1.91 mL/kg/min, with the largest average increase observed among adolescents without overweight who initially had low CRF. The increase among adolescents with overweight and low CRF was statistically uncertain.

The fitness gains were modest, and their clinical relevance remains unclear. Mean body fat percentage increased slightly across all four groups, and changes in resting cardiovascular measures were inconsistent.

After adjustment for baseline measurements, the analysis identified no statistically significant interactions between BMI status and CRF status for cardiovascular, body composition, or physical performance outcomes. Of these outcomes, weight status was significantly associated only with post-intervention SBP. Adolescents with overweight had higher adjusted SBP after the intervention than those without overweight.

Mean SBP decreased by approximately 4 mmHg in each of the two groups without overweight, compared with less than 1 mmHg in each group with overweight. These differences do not establish that HIIT was more effective in adolescents without overweight.

There was no statistically significant main effect of CRF status on the outcomes evaluated after adjustment for baseline values. Comparisons between the two overweight groups also showed considerable uncertainty, partly because of their small sample sizes. Analyses using continuous BMI and estimated VO2max similarly identified no significant interaction effects.

The responder analyses showed no significant associations between the combined weight and fitness categories and individual responses for any outcome. The researchers found no statistically significant evidence that adolescents with overweight and higher initial CRF were more likely to achieve favorable changes in blood pressure than those with lower initial CRF.

The predefined response thresholds did not account for study-specific measurement error or test-retest variability, limiting conclusions about genuine physiological responses to exercise.

Regression models explained less than 9% of the variation in individual changes. Sex was associated with changes in standing broad jump performance and heart rate reserve. Baseline estimated VO2max was also associated with changes in heart rate reserve. These isolated

associations warrant caution because the researchers examined multiple outcomes in an exploratory analysis. Baseline BMI and estimated VO2max had limited predictive value for changes in cardiovascular, body composition, or physical performance measures.

Conclusion

The results showed no statistically significant interaction between initial weight status and CRF concerning the measured health and fitness outcomes after the 8-week study period.

Mean estimated CRF, vertical jump height, and standing broad jump distance increased across all four categories, though several improvements were statistically uncertain. Fitness gains did not consistently coincide with favorable changes in resting cardiovascular measures or body composition.

The small number of adolescents with overweight, the absence of participants with obesity, and the lack of biochemical cardiometabolic measurements limit the interpretation of these findings. The small subgroups also limited the statistical power to detect differences associated with initial fitness. Diet, sleep, habitual physical activity, and biological maturation were not fully controlled.

The absence of a concurrent control comparison prevents the observed changes from being attributed directly to HIIT.

The findings do not invalidate the “fat but fit” concept, as higher fitness may still be associated with better cardiovascular health independently of short-term exercise responses. Larger, adequately powered controlled studies with longer follow-up are needed to determine whether fitness gains translate into sustained cardiovascular benefits and whether these differ according to baseline weight and fitness status.

Source:

https://www.news-medical.net/news/20261118/Can-teenagers-be-e2809cfat-but-fite2809d-What-eight-weeks-of-school-exercise-revealed.aspx