

Effects of a Strength and Stretching Program, Combined or Isolated, on Active Flexibility in Physical Education Setting.

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Purpose. To examine the effects of a two-session-per-week strength and stretching program on sit and reach score among high-school students in the physical education setting.

Methods. A sample of 46 high-school students (16 girls and 30 boys) aged 12-14 years from four classes were clustered and randomly assigned to a strength group (n=8), a stretching group (n=12), a strength + stretching group (n=16) or a control group (n=10). During physical education classes, the experimental students performed a 1-minute stretching, a 1-minute strength or a 2-minutes strength + stretching program twice a week a total of 20 weeks. Control students performed the same physical education classes, but they did not follow any strength and/or stretching program. Active flexibility (estimated by the classic sit-and-reach test) was assessed at the beginning and at the end of the intervention program.

Results. The Wilcoxon test results showed that students that performed a combined strength and stretching program increased statistically significantly their active flexibility levels from pre-intervention to post-intervention ($\Delta = 1.8 \pm 3.2$ cm; $p < 0.05$). However, for students that performed an isolated program and control group students statistically significant differences were not found (strength group, $\Delta = 0.6 \pm 0.7$ cm; stretching group, $\Delta = 0.3 \pm 2.3$ cm; control group, $\Delta = 0.7 \pm 1.5$ cm; $p > 0.05$).

Discussion. The group of students that performed a combined strength and stretching program increased statistically significantly their active flexibility levels, while for students that performed an isolated program and control group students statistically significant differences were not found. Unlike in our research, previous studies have shown that a PE-based static stretching program improves students' hamstring extensibility in secondary schoolchildren (Mayorga-Vega et al., 2015; Sainz de Baranda, 2009). And several studies, mostly on adults and elderly, have found that isolated strength training promotes flexibility gains (Barbosa et al., 2002; Monteiro et al., 2008; Simao et al., 2011). Also two studies performed with high school students found increases in hamstrings flexibility both with eccentric training and with static stretch training (Nelson and Bandy, 2004; Nelson, 2006). Probably 1 min of static stretching or 1 min of strength training were not enough for promoting flexibility gains, but the combination of 1 min of strength plus 1 min of static stretch was enough stimulus. Besides, in our study the strength training was trough isometric contraction of the antagonist of stretched muscle.

Conclusiones. Since in physical education many curricular contents need to be developed each academic year and the subject is also restricted by its limited curriculum time allocation, teachers could improve students' flexibility combining stretching and strength workout. Therefore, in addition to the improvement of students' flexibility levels, this intervention program might permit regular development of other physical education curricular contents. This knowledge could help and guide teachers to design programs that guarantee a feasible and effective development of flexibility in the physical education setting.

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