

FITNESS

Effect of a Two-Sessions-Per-Week Stretching Program on Hamstring Extensibility in Latino High School Students

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Abstract

This study explored the effectiveness of a stretching program on hamstring extensibility among Latino high school students in a physical education (PE) setting. Students, aged 13 to 15, in five required PE classes were assigned to either an experimental group ($n = 60$) or a control group ($n = 42$). Experimental students performed a 3-min stretching program twice a week for 9 weeks. Participants hamstring extensibility was recorded at baseline, in the middle (Week 5), and at the end (Week 9) of the stretching intervention program via the FitnessGram sit-and-reach test. The results of t tests revealed a significant improvement for the experimental group from pretest to posttest ($p < .002$), from posttest to retest ($p < .03$), and from pretest to retest ($p < .0004$). In contrast, no significant differences were found for the control group ($p > .05$). The results suggest PE teachers can improve student hamstring extensibility by incorporating a 3-min, twice-a-week stretching program.

Flexibility is an important component of health-related physical fitness (Centers for Disease Control and Prevention, 2011). However, a large number of school children have inadequate hamstring

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extensibility, which has been linked to neck tension and lower back pain in adults and to increased incidence of herniated disks (Coledam et al., 2012; Mayorga-Vega, Merino-Marban, Garrido, & Viciano, 2014; Mayorga-Vega, Merino-Marban, Vera-Estrada, & Viciano, 2014; Santonja et al., 2007). In contrast, children with adequate hamstring extensibility have demonstrated less likelihood of pelvic/spinal postural disorders (De Lemos et al., 2012; Lopez-Minarro & Alacid, 2010; Muyor et al., 2012).

According to Rodriguez et al. (2008), loss of hamstring extensibility begins to occur during the prepubertal period and increases during later growth stages. This decline appears to be related to increased musculotendinous stiffness around the joint, due to faster bone development and growth compared to the muscle (Micheli, 1983). The recent decline in hamstring extensibility can be attributed to a physically inactive lifestyle in which children prefer watching television, playing video games, and other nonactive activities (Rodriguez et al., 2008).

A flexibility program in a physical education (PE) setting can improve hamstring extensibility and reduce the incidence of lower back pain (Coledam et al., 2012; Mayorga-Vega, Merino-Marban, Garrido, & Viciano, 2014; Mayorga-Vega, Merino-Marban, Vera-Estrada, & Viciano, 2014; Kamandulis et al., 2013; Merino-Marban et al., 2015; Sanchez Rivas et al., 2014). Consequently, experts have recommended PE programs offer students a regular program of stretching exercises (Mayorga-Vega et al., 2017). Rodriguez et al. (2008) found that both elementary school children and secondary school children achieved significant increases in sit-and-reach scores following a 5-min stretching program performed during the warm-up and cooldown sessions of PE class.

Stretching programs have also been shown to be more effective when they are more frequent. Mayorga-Vega, Merino-Marban, Garrido, and Viciano (2014) found that third graders achieved significant improvements in sit-and-reach scores over 32 weeks that involved stretching sessions of just 3 min, once a week. Santonja et al. (2007) found that students who performed 5 min of hamstring stretches in both a PE class twice a week and an extracurricular activity program achieved significantly greater gains than those who just performed the stretches in a PE class.

Because past studies have confirmed the benefits of stretching programs in various youth populations, a study was deemed important to determine whether a twice-a-week stretching program as short in duration as 9 weeks could improve hamstring extensibility among male and female Latino high school PE students. Limiting the study to Latino high school students may make important generalizations possible. In addition, assessing hamstring extensibility at baseline, at 5 weeks, and again at 9 weeks may make it possible to determine whether improvements in hamstring extensibility occur incrementally, over time, for both boys and girls. Finally, since the average BMI of the participants in this study was in the Needs Improvement Zone of the FitnessGram, comparisons of the results with studies utilizing participants with healthier BMI levels might be possible.

Method

This study used an experimental design with two control groups and three experimental group classes, all taught by the same instructor at one public charter high school in the Southwestern United States. The study was conducted from January to March 2018 with the permission of the school district IRB official. Participants included 53 male and 49 female ninth graders. All the students indicated their race/ethnicity was Latino. Prior to the stretching intervention program, students were asked which sports they participated in, as well as the number of days and average time per session. Height and weight were each taken twice and the average measurement was used (International Society for the Advancement of Kinanthropometry, 2001).

During each intervention session, the experimental group students performed static hamstring stretches for 3 min during the cooldown period, using the same protocol as used in Mayorga-Vega, Merino-Marban, Garrido, and Viciano (2014). Four stretching exercises were alternated during the intervention program: (a) standing with feet together, (b) sitting with feet together, (c) standing with feet shoulder width apart, and (d) sitting with feet shoulder width apart. During the stretching exercises, students flexed forward their bodies at the hip, trying to maintain the spine in neutral position as much as possible until a gentle stretch was felt in the hamstrings. The knees were fully extended and toes pointed to the ceiling with no hip

rotation. The stretched positions were held gently until the end point of the range was reached (i.e., stretch to the point at which tightness of the hamstring muscles, but no pain was felt). Once this position was achieved, students held each stretch for 20 s.

Hamstring extensibility was measured using the FitnessGram sit-and-reach test prior to the start (baseline), at the middle (Week 5), and at the end (Week 9) of the 9-week intervention stretching program. The same tester administered the sit-and-reach test using a plastic box with a scale printed in inches and centimeters on top. In addition, the test was performed under similar environmental conditions in all five classes. Students were asked to refrain from any strenuous physical activity 48 hr prior to the test date; the test was executed on the same day of the week for each participant. Two trials were performed and the average was recorded (Mayorga-Vega et al., 2015).

Scores were entered into a spreadsheet. Descriptive statistics (means and standard deviation) for body weight, body height, BMI, and baseline sit-and-reach scores were calculated. A *t* test determined if any significant differences occurred over the 9-week period for sit-and-reach scores for any of the classes.

Results

Table 1 shows students' general characteristics. Of the 102 students in the study, 53 (51.9%) were male and 49 (48.1%) were female. The results of the one-way analysis of variance determined there were no statistically significant differences in the anthropometric measures (body mass, body height, BMI, sit-and-reach baseline values) between the control group and the experimental group ($p > .05$).

Table 2 shows the effect of the hamstring extensibility stretching intervention program on sit-and-reach scores. The *t* test results indicated a statistically significant improvement for the experimental group from pretest to Week 5 ($p < 0.002$), from Week 5 to Week 9 ($p < .03$), and from pretest to Week 9 ($p < .000$). In contrast, no significant differences were found for the scores of the control group ($p > .05$). The *t* test results demonstrated a significant improvement for the female participants from pretest to Week 5 ($p < .03$) and from Week 5 to Week 9 ($p < .004$). The *t* test results for males demonstrated a significant difference from pretest to Week 5 ($p < .006$) but no significant difference from Week 5 to Week 9 ($p > .05$).

Table 1*Demographic Data for Hispanic High School Students Enrolled in Required Physical Education Classes*

Demographic data	Total (<i>N</i> = 102)	Experimental (<i>n</i> = 60)	Control (<i>n</i> = 42)
Body height (m), <i>M</i> ± <i>SD</i>	1.62 ± 0.08	1.62 ± 0.08	1.62 ± 0.07
Body mass (kg), <i>M</i> ± <i>SD</i>	70.06 ± 20.33	71.28 ± 22.92	68.33 ± 16.03
Body mass index (kg/m ²), <i>M</i> ± <i>SD</i>	26.35 ± 7.02	26.79 ± 7.85	25.71 ± 5.64
Gender (boys/girls)	53/49	29/31	24/18
Extracurricular (yes/no)	5/97	3/57	2/40
Sit-and-reach score (cm), <i>M</i> ± <i>SD</i>	21.51 ± 4.76	22.69 ± 4.3	19.83 ± 4.93

Table 2*Means and Standard Deviations of Sit-and-Reach Scores for Hispanic High School Students Enrolled in Required Physical Education Classes*

Group	Pretest (1) <i>M</i> ± <i>SD</i>	Week 5 (2) <i>M</i> ± <i>SD</i>	Week 9 (3) <i>M</i> ± <i>SD</i>
Experimental (<i>n</i> = 60)	22.69 ± 4.3	24.20 ± 3.65 ^t	25.69 ± 5.67 ^{^*}
Girls EG (<i>n</i> = 31)	23.51 ± 4.63	25.13 ± 3.82 ^t	27.10 ± 4.18 ^{^*}
Boys EG (<i>n</i> = 29)	21.80 ± 3.81	23.21 ± 3.23 ^t	23.64 ± 6.37 [*]
Control (<i>n</i> = 42)	19.83 ± 4.93	19.29 ± 4.54	18.50 ± 5.50

^t *p* < 0.05 Pretest to Week 5 gain. [^] *p* < 0.05 Week 5 to Week 9 gain. ^{*} *p* < 0.05 Pretest to Week 9 gain.

Discussion

The findings indicate that a PE-based stretching program on hamstring extensibility performed for 3 min/session, twice a week for 9 weeks significantly improved hamstring extensibility. These findings are consistent with those of studies of a comparable length in which primary school children who performed a PE-based stretching program experienced a significant improvement in hamstring extensibility (Mayorga-Vega, Merino-Marban, Garrido, & Viciana, 2014; Mayorga-Vega et al., 2017; Mayorga-Vega, Merino-Marban, Vera-Estrada, & Viciana, 2014; Merino-Marban et al., 2015; Rodriguez et al., 2008). It is important to note that while all 97 of the high school students in this study were enrolled in a required PE

class, only 5% reported concurrently participating on an interscholastic athletic team.

The improvements in hamstring flexibility appeared to be incremental for the experimental group, particularly for the females. Because the scores increased steadily over the 9 weeks for the experimental group classes, it is likely that greater gains would have been achieved had the frequency been increased from twice a week (Rodriguez et al., 2008; Santonja et al., 2007).

The lack of improvement for the control group is not surprising and illustrates the inadequacy of most PE programs in regard to enhancing hamstring flexibility. Similar to the experimental group, the control group also participated in a standardized warm-up, which allowed adequate muscular temperature prior to the three hamstring flexibility testing sessions during the 9 weeks; however, they did not participate in the twice-a-week flexibility sessions.

Females generally achieved better hamstring flexibility scores than males did. This finding is not surprising since studies have shown that females have greater hip flexibility (Mier & Shapiro, 2013); consequently, it is assumed that females will score better than males on the sit-and-reach test since there is a positive correlation between flexibility and exercises that involve the hip region.

A limitation of the present study is the small, nonrandomized sample size. The study was conducted in a small charter high school in the Southwestern United States. The school has a population of 230 students, of whom 115 are in the ninth grade. The relatively high average BMI (26.35) of the students was in the Needs Improvement category for the FitnessGram, with many of the students in the NI-Health Risk category. A study of students of a similar age by Arora et al. (2013) demonstrated a weak correlation between BMI and hamstring flexibility, and other studies involving Sumo wrestlers with high BMIs have found similar results (Alter, 2004). Future research should study the effect of the stretching programs with a large, randomized sample size. However, using a homogenous population (Latino) provides important data that can be compared with other ethnic groups.

In regard to practical applications, physical educators should incorporate stretching programs that help students develop and maintain both hamstring flexibility and core flexibility (Mayorga-Vega et al., 2017). Time for flexibility training could occur as part

of a structured warm-up, a fitness station that is part of a circuit, or during a cooldown at the end of a lesson. Ideally, stretching should be a part of daily PE classes as well as during extracurricular periods (Merino-Marban et al., 2015). Not only will this enhance the health of the students, but it should also increase the possibility of a score in the healthy zone for the sit-and-reach subtest of the FitnessGram.

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