Following a specially-designed program of warm-up exercises (PEP program) significantly improves muscle strength and flexibility and biomechanical imbalances blamed for the [epidemic of anterior cruciate injuries among female athletes](http://www.momsteam.com/node/803), a new study says.

Researchers in South Korea found that female high school basketball players following a slightly modified version of the [Prevent Injury and Enhance Performance program](http://www.aclprevent.com/PEPExercises.pdf) over an 8-week period had better strength, flexibility and biomechanics compared with a control group not following the program. The findings are reported in the September 2009 issue of the *American Journal of Sports Medicine.* 1

**Increased compliance**

The study noted that one of the advantages of the PEP program over other injury prevention programs developed in recent years to reduce the risk of ACL injuries in female athletes is that it takes only 15 minutes during warm up and 5 minutes during warm/cool down to complete and can be integrated into a team's pre-practice or game routine.  This makes implementation feasible and practical, even for younger populations, and increases compliance.

The study was "exactly what we wanted to see," said Holly Silvers, MTP, ACL Prevention Project Coordinator at the [non-profit Santa Monica Orthopedic and Sports Medicine Research Foundation](http://www.aclprevent.com/pepprogram.htm), which developed the popular PEP program a decade ago. It is "valuable because it shows that the PEP is not only practical, cost effective, and uses time efficiently - all factors that affect compliance -  but that it works."

The advantage of PEP, Silvers noted, is that, because it is a warm-up program, it essentially "kill two birds with one stone: not only reducing the specific ACL injury risk to female athletes but the more [general risk of injury resulting from inadequate warm-up](http://www.momsteam.com/node/2606) before sports."

**Season-long program urged**

The athletes involved in the Korean study followed the program for 8 weeks, and the authors speculated that a minimum of 4 to 6 weeks was needed to obtain measurable benefits in ACL injury reduction. Silvers, however, recommends that the PEP exercise regimen be started in the pre-season and continue over the course of the entire season.  "We are finding in our studies that the benefits of PEP, not just in reducing non-contact ACL injuries to which female athletes are particularly susceptible, but in those resulting from player-to-player contact, is particularly significant in the second half of a season."

**PEP (Prevent Injury and Enhance Performance) Training Program (Overview)2**

|  |  |  |
| --- | --- | --- |
| Exercise | Distance | Repetitions/Elapsed Time |
| 1. **Warm-Up** |  |  |
| **Jog line to line** (cone to cone) | Soccer: End line to midfield and back  Basketball: 100 yards | Elapsed time: 0 - .5 minute |
| **Shuttle Run** (side to side) | Soccer: End line to midfield and back  Basketball: 100 yards | Elapsed time: .5 to 1 minute |
| **Backward Running** | Soccer: sideline to sideline  Basketball: 100 yards | Elapsed Time: 1 - 1.5 minutes |
| 2. **Stretching** |  |  |
| **Calf stretch** |  | 30 seconds x 2 reps; Elapsed Time: 1.5 to 2.5 minutes |
| **Quadriceps stretch** |  | 30 seconds x 2 reps; Elapsed Time: 2.5 to 3.5 minutes |
| **Figure Four Hamstring stretch** |  | 30 sec x 2 reps; Elapsed time: 3.5 to 4.5 minutes |
| **Inner thigh stretch** |  | 20 sec x 3 reps; Elapsed time: 4.5 to 5.5 minutes |
| **Hip flexor stretch** |  | 30 sec x 2 reps; Elapsed time: 5.5 to 6.5 minutes |
| **3. Strengthening** |  |  |
| **Walking Lunges** |  | 3 sets x 10 reps; Elapsed time: 6.5 to 7.5 minutes |
| **Russian Hamstring** |  | 3 sets x 10 reps; Elapsed time: 7.5 to 8.5 minutes |
| **Single Toe Raises** |  | 2 sets x 30 reps; Elapsed time: 8.5 to 9.5 minutes |
| 4. **Plyometrics** |  |  |
| **Lateral hops over cone** |  | 20 reps; Elapsed time: 9.5 to 10 minutes |
| **Forward/backward hops over cone** |  | 20 reps; Elapsed time: 10 to 10.5 minutes |
| **Single-leg hops over cone** |  | 20 reps; Elapsed time: 10.5 to 11 minutes |
| **Vertical jumps with headers** |  | 20 reps; Elapsed time: 11 to 11.5 minutes |
| **Scissors jump** |  | 20 reps; Elapsed time: 11.5 to 12 minutes |
| 5. **Agilities** |  |  |
| **Shuttle run with forward/backward running** |  | Elapsed time: 12 to 13 minutes |
| **Diagonal runs** |  | Elapsed time: 13 to 14 minutes |
| **Bounding runs** | 44 yards | Elapsed time: 14 to 15 |
| **6. Alternative exercises - Warm down and Cool Down** |  |  |
| **Bridging with alternating hip flexion** |  | 30 reps on each side |
| **Abdominal crunches** |  | 30 reps x 2 reps |
| **Single and double knee to chest (supine)** |  | 30 sec x 2 reps |
| **Figure Four Piriformis stretch - supine** |  | 30 sec x 2 reps |
| **Seated butterfly stretch-seated** |  | 30 sec x 2 reps |

1. Lim, Bee-Oh, et al. "Effects of Sports Injury Prevention Training on the Biomechanical Risk Factors of Anterior Cruciate Ligament Injury in High School Female Basketball Players." *American Journal of Sports Medicine* 37, no. 9 (2009); 1728-1734*.*

2. To download a free copy of the full PEP program, click [here](http://www.aclprevent.com/PEPExercises.pdf).

Read more: <http://www.momsteam.com/health-safety/warm-up-program-reduces-female-acl-injury-risk-study#ixzz0ud7mNh1P>