

# Preventing Running Injuries Using a Pre-Running Exercise Program (PREP): A Pilot Study

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## Introduction

- Although running has many health benefits, those who are new to running have an injury incidence of 30-79% (Buist 2010).
- One of the most common running related injuries (RRI's) is patellofemoral pain syndrome (PFPS) (Lopes, 2012), occurring at a rate of 12-15% among novice runners (Boling, 2010).
- Some risk factors have been identified (Nielsen, 2012), but prevention programs have been unsuccessful (Bredeweg, 2012).
- PFPS is commonly treated with hip strengthening and dynamic control of lower extremity frontal plane mechanics (Willy, 2012).
- We aimed to determine if implementing a supervised pre-running exercise program (PREP) focusing on trunk and lower extremity dynamic strength and control could reduce the incidence of RRI's in novice runners training for a 5k run.

## Hypothesis

- An 8 week supervised PREP implemented prior to a 5k running program will reduce the incidence of RRI's among novice runners training for a 5k below the previously published incidence rates.

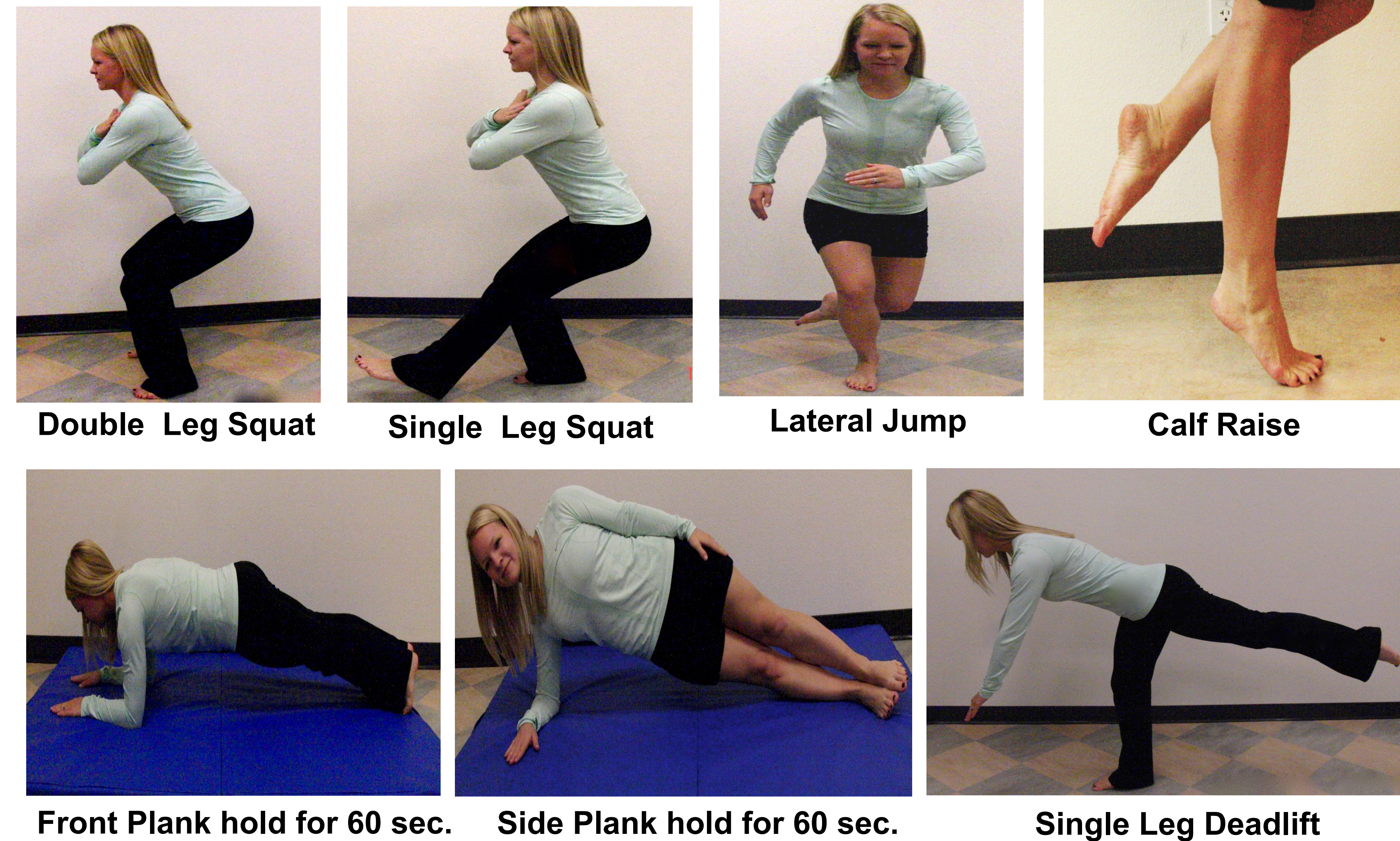
## Methods

| Wk | Monday                | Tuesday | Wednesday             | Thursday              | Friday                | Sat         | Sun  | % Run | Total Miles |
|----|-----------------------|---------|-----------------------|-----------------------|-----------------------|-------------|------|-------|-------------|
| 1  | Pre PREP Test         | Rest    | Rest                  | Rest                  | PREP begins           | Rest        | Rest |       |             |
| 2  | PREP                  | Rest    | PREP                  | Rest                  | PREP                  | Rest        | Rest |       |             |
| 3  | PREP                  | Rest    | PREP                  | Rest                  | PREP                  | Rest        | Rest |       |             |
| 4  | PREP                  | Rest    | PREP                  | Rest                  | PREP                  | Rest        | Rest |       |             |
| 5  | Run - 1 mile run/walk | PREP    | Rest                  | Run - Long 2          | PREP                  | Rest        | Rest | 25%   | 3           |
| 6  | Run - Long 2.5        | PREP    | Rest                  | Run - 1 mile run/walk | PREP                  | Rest        | Rest | 25%   | 3.5         |
| 7  | Run - Long 3          | PREP    | Rest                  | Run - 1 mile run/walk | PREP                  | Rest        | Rest | 50%   | 4           |
| 8  | Run - Long 3          | PREP    | Rest                  | Run - 1 mile run/walk | Post PREP Test        | Rest        | Rest | 50%   | 4           |
| 9  | Run - Long 3          | Rest    | Run - 1 mile run/walk | Rest                  | Run - 1 mile run/walk | Rest        | Rest | 75%   | 5           |
| 10 | Run - Long 3          | Rest    | Run - 1 mile run/walk | Rest                  | Run - 1 mile run/walk | Rest        | Rest | 75%   | 5           |
| 11 | Run - Long 2          | Rest    | Run - 1 mile run/walk | Rest                  | Rest                  | <b>RACE</b> |      | 100%  | 6           |

- 12 week prospective study (8 week PREP + progressive 5k running program beginning at week 4)
- Pretest and posttest measures were performed at weeks 1 and 8, respectively, these included:
  - weight, countermovement jump-land video analyzing frontal plane kinematics, isometric hip abduction strength, single leg calf raise, and side plank endurance.
- Occurrence of running related injuries (any musculoskeletal complaint of the lower extremity or back caused by running, resulting in a restriction of running for at least 1 week) were reported throughout the study during exercise sessions.

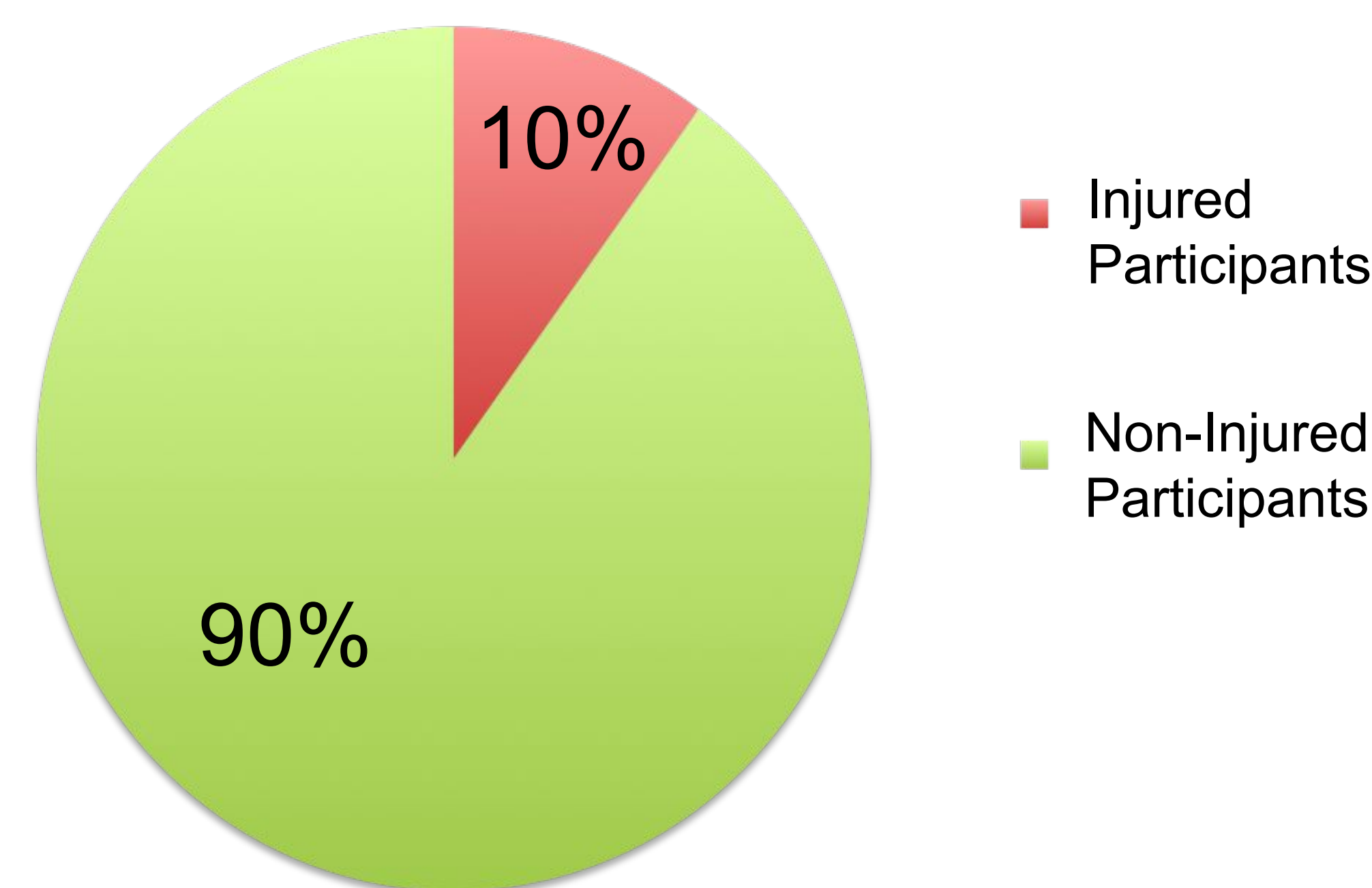
## The PREP

Runners began each session with a 5 minute dynamic warm-up, then performed the PREP:



## Results

### Injury Rates



Video analysis of Landing angle Assessment

- 9 females and 3 males began the study (n=12). 1 male & 1 female did not complete the study due to non-injury reasons (16.7% attrition). Average attendance of supervised sessions was **63.4%**.
- Calf raises and side planks yielded no significant changes due to a strong ceiling effect.
- Due to large variation, neither eccentric hip abduction or landing angle changed significantly ( $p>0.05$ )

**1 subject developed a RRI requiring them to stop running for 1 week.**

## Discussion

- Only 10% of our subjects developed a RRI, which is much lower than the published rate of 30-79% (Buist, 2010).
- The 1 injured subject developed PFPS at week 5, but reported they have had previous hip and ankle injuries, which may have been contributing factors.
- Many participants met the limit for calf raises (20 reps) and side plank (1 min), creating a ceiling effect.
- Eccentric hip abduction strength data was likely skewed due to high variability and a small sample size.
- Landing angle measurements from the squat jump were limited due to the use of a single camera measuring frontal plane kinematics, which could not account for transverse plane variations in landing patterns.

## Conclusion

- A supervised exercise program combining hip and core strengthening, balance, and light plyometrics initiated prior to a 5k running program may reduce the incidence of RRI's among novice runners.
- Our study was limited by a low number of participants, inconsistent secondary measures, and lack of a control group. These results should be interpreted with caution.
- Future studies should utilize a larger sample size, more stringent observation, and more valid and reliable secondary measures.

## References

- Boling, M., Padua, D., Marshall, S., Guskiewicz, K., Pyne, S., & Beutler, A. (2010). Gender differences in the incidence and prevalence of patellofemoral pain syndrome. *Scandinavian Journal Of Medicine & Science In Sports*, 20(5), 725-730. doi:10.1111/j.1600-0838.2009.00996.x
- Bredeweg, S. W., Zijlstra, S., & Buist, I. (2010). The GRONORUN 2 study: effectiveness of a preconditioning program on preventing running related injuries in novice runners. The design of a randomized controlled trial. *BMC Musculoskeletal Disorders*, 11(196-203). doi:10.1186/1471-2474-11-196
- Buist, I., Bredeweg, S. W., Bessem, B., van Mechelen, W., Lemmink, L. A., & Diercks, R. L. (2010). Incidence and risk factors of running-related injuries during preparation for a 4-mile recreational running event. *British Journal Of Sports Medicine*, 44(8), 598-604.
- Lenhart, R. L., Thelen, D. G., Willie, C. M., Chumanov, E. S., & Heiderscheidt, B. C. (2014). Increasing Running Step Rate Reduces Patellofemoral Joint Forces. *Medicine & Science In Sports & Exercise*, 46(3), 557-564. doi:10.1249/MSS.0b013e3182a78c3a
- Lopes, DA., Hespagnol Junior, L. C., Yeung, S. S., & Pena Costa, L. O. (2012). What are the Main Running-Related Musculoskeletal Injuries?. *Sports Medicine*, 42(10), 891-905.
- Nielsen, R., Buist, I., Sorensen H., Lind, M., Rasmussen, S. (2012). Training Errors and Running Related Injuries: A Systematic Review. *International Journal of Sports Physical Therapy*, 7 (1), 58-71.
- Willy, R. W., Scholz, J. P., & Davis, I. S. (2012). Mirror gait retraining for the treatment of patellofemoral pain in female runners. *Clinical Biomechanics*, 27(10), 1045-1051. doi:10.1016/j.clinbiomech.2012.07.011