Investigation of the relationship between the severity and frequency of knee injuries and weak core muscles in runners

Background
The goal of my research is to determine whether there exists a relationship between weak core muscles and knee injuries in runners. The term "core" will be used to refer to the abdominal, lumbar, and pelvic muscles, and runners will be those who run an average of at least three times per week. I will investigate the severity and frequency of knee injuries of runners and the strength of the core area. Participants in the research will complete a questionnaire about the severity and frequency of their past and present knee injuries. They will then complete five physical tests to determine relative core strength. If my research data indicate a correlation between core strength and the prevalence of knee injuries, then runners might reduce the severity and frequency of knee injuries by performing exercises to strengthen their core muscles.

I selected this research topic because I am a runner and have been injured as a result of poor core strength. I ran cross country for three years and suffered tendonitis in my IT band and inflammation in a pelvic joint as a result of poor core strength. Several of my teammates suffered similar injuries. Runners are especially vulnerable to overuse injuries, and studies suggest that about 25 percent of running injuries occur in the knee. I speculate that one possible cause of knee injuries is abnormal pelvic movement that may alter foot plant and knee movement. Strong core muscles may reduce pelvic movement by controlling the pelvic area.

I have research experience through my involvement of various academic activities. I have competed in Future Problem Solving state competitions for three years, conducted and judged science fair projects for thirteen years, completed an extensive research report on obesity in 11th grade, and reviewed research on the causes of Alzheimer’s this year. From these experiences, I have learned how to identify a problem, how to design and conduct research, and how to use problem-solving skills to solve problems. I am currently enrolled in AP Physics, which teaches the science behind movement. In addition, I earned an “A” in a two-semester high school anatomy course. The class included an in-depth look at body structure and function with hands-on examinations. With my track team, I attended core strength-training seminar that taught which movements benefit from a strong core. Currently, I am researching strength and injuries as related to running and discussing this project with the athletic trainer and running coaches at my school.

Purpose
In my experience, many runners rely on running more to increase speed and endurance, and many are injured as a result. Knee injuries are the most common complaint of runners. Although these injuries stem from many causes, the purpose of my research is to investigate a link between knee injury and core muscle strength. If core strength is determined to be a factor in knee injuries, runners may be able to prevent or reduce knee injuries by increasing their core strength.

Method
During the next six months, I will research this topic more extensively. I will read periodicals, talk with physical therapists, runners and coaches, and familiarize myself with the specific anatomical components of the core area. I will also review the procedures and results of research on topics related to mine. To begin the study, I will distribute a questionnaire to runners who are willing to participate in the study. Participants will represent various ages and abilities. The questionnaire will include questions about past and present knee injuries, average weekly workouts and strength regiment. The members of cross country and track teams will be asked to participate in the study. To ensure a blind experiment, I will not look at the questionnaires until the physical evaluations are complete. I will then test the individuals for core strength.

The participants will wear a tight shirt and shorts, be prepped on the premise of the research, and watch a demonstration of each exercise. The participants will perform Trendelenburg’s test, recumbent leg levers, “bugs and dogs,” military bridges, walking lunges, and stationary high knees. The exercises will test the strength and endurance of the lower abdomen, lower back, and pelvic muscles.

The participants will be asked to maintain a flat back, level hips and a generally stable core area while performing the exercises. To judge the performances, I will observe from the sides and front as the tests are performed. I will measure the time the military bridges position is sustained. For the other tests, I will use a numerical system to rate the level of arch in the lower back from vertical, rise and fall of the hips from horizontal, and knee alignment between the foot and hip. If necessary, the tests will also be videotaped (with participant permission) for further analysis. Since I will perform all evaluations, any researcher bias will be constant throughout the study. Precautions will be taken to prevent injuries during the study. After the physical evaluations are complete, follow-up questions will confirm the validity of the questionnaires.

After the participants complete the questionnaires and physical tests, I will organize the data in a spreadsheet. Using a chart, I will be able to determine how many participants with a weak core have had severe and frequent knee injuries. If data support my initial hypothesis, I will report the test results to the participants and suggest exercises they might perform to increase core strength. I anticipate that the analysis of the results from this research might suggest other variable such as the gender of the runners might influence knee injuries. Further research could investigate possible correlations among these variables and knee injuries in runners.

The results from this research will be presented in 2006 at the Truman Student Research Conference or the National Conference on Undergraduate Research.