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The Effects of the FIFA 11+ Warm Up Program in Female Collegiate Soccer Athletes

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May 2016

To the Dean of the Graduate School:

We are submitting a thesis written by Stacey O'Neill entitled THE EFFECTS OF THE FIFA 11+ WARM UP PROGRAM IN FEMALE COLLEGIATE SOCCER ATHLETES.

We recommend acceptance in partial fulfillment of the requirements for the degree of Master of Science in Sport and Fitness Administration through the Richard W. Riley College of Education.

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THE EFFECTS OF THE FIFA 11+ WARM UP PROGRAM IN
FEMALE COLLEGIATE SOCCER ATHLETES

A Thesis
Presented to the Faculty
Of the
Richard W. Riley College of Education
In Partial Fulfillment
Of the
Requirements for the Degree
Of
Master of Science
In Sport and Fitness Administration
Winthrop University

May, 2016

By
Stacey O'Neill

Abstract

As of 2010 there were over 265 million registered soccer athletes worldwide, and in particular, the number of women players were rapidly increasing (Soligard, et al., (2010). Consequently, playing soccer accounts for approximately one quarter of all injuries in sport, and due to its nature of jumping, pivoting and cross-cutting, the majority of these are non-contact, lower extremity injuries. Therefore, playing soccer entails a substantial amount of injury risk for its participants. The purpose of this study was to investigate the effects of the FIFA 11+ Warm Up Program in collegiate female soccer athletes.

The research design used in this study was a quasi-experimental design to determine if there was a cause and effect relationship between the pre and post-testing data. There was not a control group utilized in this study. Thirteen collegiate female soccer athletes participated in an eight week protocol following the FIFA 11+ Warm Up Program. The warm up took place prior to spring practice sessions and was led by the participating team's coaching staff. All participants completed pre-test assessments of strength, dynamic and static balance, and agility. The Biodex System 3 was used to assess hamstring and quadriceps (H/Q) muscle ratios at 90, 180 and 300 degrees per second. Dynamic balance was measured with the Biodex balance system, and static balance was measured with the Balance Error Scoring System (BESS). The 5-dot agility test was used to measure agility. Pre and post-testing were all performed following a ten-minute warm up on a stationary bike. Subjects completed the test in the following order: Biodex balance system, BESS, 5-dot agility test and the Biodex dynamometer. All data were analyzed using the Statistical Package for the Social Sciences (SPSS). Results were calculated using paired-sample *t* test. Although not all outcomes produced statistical significance, all means showed a trend toward improvement. Significant values included H/Q ratio of the non-dominant leg at 90 degrees/second and agility performance. It is recommended that future researchers conduct the study using a larger sample size. It is also suggested that a control group who trains at the same level as participants be used for comparison and that the researcher instruct subjects through the FIFA 11+ exercises. If possible, a comparison of female and male soccer athletes using this program should be conducted and injury data be tracked. Lastly, all testing procedures should be conducted by the same individual in pre and post-test data collection.

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Chapter 1

Introduction

As of 2010 there were over 265 million registered soccer athletes worldwide, and in particular, the number of women players was rapidly increasing (Soligard, et al., 2010). Consequently, playing soccer accounts for approximately one quarter of all injuries in sport, and due to its nature of jumping, pivoting and cross-cutting, the majority of these are non-contact, lower extremity injuries. Therefore, playing soccer entails a substantial amount of injury risk for its participants. Studies have stated that female soccer athletes (elite and non-elite) report the most common injuries involving knee and ankle ligaments, along with thigh muscle strains. There is an urgent need to develop training programs to prevent such injuries. There are currently very few studies on prevention of injury in female soccer athletes (Kim & Hung, 2011). The purpose of this research was to investigate the effects of the FIFA 11+ Warm Up Program in collegiate female soccer athletes.

The FIFA 11+ was developed by the Fédération Internationale de Football Association (FIFA). It is a complete warm-up program used to reduce injuries among male and female soccer players ages 14 years and older. The program was developed by an international group of experts. According to its official website, teams that performed the FIFA 11+ at least twice per week had 30-50% fewer injuries among players. FIFA stated that the program should be used at least twice a week in lieu of a standard warm-up at the start of each training session. The program requires approximately 20 minutes to complete and consists of exercises that focus on the improvement of

hamstring/quadriceps (H/Q) strength, balance, agility, and soccer specific skills (www.f-marc.com/11plus). This study examined these claims by testing isokinetic H/Q strength, dynamic and static balance, and the functional agility of subjects prior to and after the completion of the 8-week protocol following the FIFA 11+ program.

Statement of the Problem

The purpose of the study was to investigate the effects of the FIFA 11+ Warm Up Program on the development of strength, static and dynamic balance, and agility in collegiate female soccer athletes.

Research Hypotheses

The following research hypotheses were tested:

1. The FIFA 11+ Warm-up Program will result in an improvement of H/Q strength ratios.
2. The FIFA 11+ Warm-up Program will result in a decrease in balance errors for both static and dynamic balance.
3. The FIFA 11+ Warm-up Program will result in decreased time needed to complete the 5-dot agility test, therefore indicating an increase in agility performance.

Delimitations

The study was delimited by the following:

1. Participants were current female collegiate soccer athletes.

2. Participants had not experienced a concussion within the last three months.
3. Participants had not experienced a lower extremity musculoskeletal injury that would affect their balance within the last three months.
4. Participants must have the ability to correctly complete the FIFA 11+ preventive program. Subjects were instructed on how to complete exercises, and were asked to complete exercises three times per week. Progressions of exercises were applied as needed.
5. Pre-testing was conducted prior to implementation of the FIFA 11+ program.
6. Post-testing was conducted after completion of the 8-week program protocol.
7. Testing instruments included: The Biodex dynamometer, the Biodex balance system, the balance error scoring system, and a 5-dot agility test.

Limitations

1. The researcher could not control honesty of participants' completion of the program when unable to attend group sessions.
2. The researcher could not control honesty of participants when filling out demographic questionnaire.
3. The researcher could not control the loss of participants due to injuries.
4. The researcher was unable to control participants' ability to become familiar with testing devices during post-testing session.

Definition of Terms

For the purpose of this study, the following terms were operationally defined:

Collegiate soccer athlete. Any individual that participates on an officially recognized interscholastic soccer team.

Isokinetic exercise. A type of exercise that uses the focus applied by the subject as the resistance for the exercise while moving at a constant speed throughout a range of motion (Lind et al., 2005).

Biodex dynamometer (Biodex System 3). A machine that measures the isokinetic strength of the quadriceps and hamstring muscle groups at speeds of 90, 180, and 300 degrees per second.

Proprioception. Awareness of a body segment's position and orientations. (Gioftsidou, & Malliou, 2006).

Balance. Ability to achieve postural control which involves positioning the body's center of gravity within a base of support (Prentice, 2011).

Biodex balance system. A machine that measures the static balance of the lower extremities.

Balance Error Scoring System. A subjective balance assessment that involves tasks that range from simple static standing to conditions that alter peripheral sensory feedback (Patterson et al., 2014).

Agility. The ability to explosively accelerate, decelerate, and change direction (Baechle & Earle, 2000).

Hamstring and Quadriceps Ratio (H/Q Ratio). The strength of the hamstring muscle divided by the strength of the quadriceps muscle (Kim & Hong, 2011).

Chapter 2

Review of Related Literature

Soccer is one of the most popular sports and attracts many participants all over the world. Participation, however, leads to a substantial number of musculoskeletal injuries. Soccer athletes must possess proper lower extremity muscle strength and the ability to maintain balance while running or quickly changing direction (Gioftsidou & Malliou, 2006). The inability to properly execute these techniques can lead to non-contact, lower extremity injuries. Soccer is also a contact sport; therefore, participants run the risk of direct or indirect physical contact with their opponents. Studies have stated that female soccer athletes (elite and non-elite) report the most common injuries involve knee and ankle ligaments, along with thigh muscle strains (Kim & Hung, 2011; Gioftsidou, et al., 2012). To prevent such injuries, programs that focus on restoring muscle strength, H/Q ratios, and improving balance are needed (Gioftsidou & Malliou, 2006).

Female Injury Risk in Sport

It is well documented that female athletes participating in jumping and cutting sports demonstrate a four- to sixfold higher incidence of knee injuries compared to male athletes participating in the same sports (Havens & Sigward, 2015). Training of the musculature that stabilizes the knee joint before sports participation may decrease the relative injury incidence in female athletes (Hewett, Lindenfeld, Riccobene, & Noyes, 1999). Researchers have proposed that programs that focus on strengthening and restoring H/Q ratio imbalances and improve proprioception through balance training,

may decrease the relative injury incidence in female athletes (Gioftsidou & Malliou, 2006). Zeller, McCrory, Kibler, and Uhl (2003) sought to examine the difference between men and women athletes during a single-legged squat. They stated since the single-leg squat is a common maneuver that is important during cutting, jumping, and balance specific sports, observing the differences between men and women could present data in reference to possible risk factors for noncontact anterior cruciate ligament (ACL) injuries. Their study included 18 intercollegiate athletes (nine male and nine female). All subjects performed five single-leg squats on their dominant leg. Kinematic cameras and surface electrodes were used to record the movements of the athletes. The kinematic results showed that the female athletes demonstrated significantly more ankle dorsiflexion, ankle pronation, hip adduction, hip flexion, and hip external rotation. It also revealed that women start and complete the task with their knee in a more valgus position relative to the men. The electromyographical results showed a statistically greater activation of the rectus femoris muscle in women compared to men. Zeller et al. (2003) concluded that these strength differences and neuromuscular characteristics were potential risk factors that contributed to the higher likelihood of female athletes sustaining a non-contact ACL injury versus male athletes.

Hanson, Padua, Blackburn, Prentice, and Hirth (2008) examined the differences in lower extremity muscle activation between male and female collegiate soccer athletes during two side-step cutting maneuvers. The subjects included 20 male and 20 female National Collegiate Athletic Association (NCAA) Division I varsity soccer players. All participants performed a running-approach side-step cut and a box-jump side-step cut.

Surface electrodes were used to record muscle activation during the movements. A quadriceps-dominant muscle activation pattern was observed in female compared to male subjects. It was found the quadriceps-dominant female subjects also demonstrated low hamstring activation during the movements. Hanson et al. (2008) concluded that the relationship between this increased quadriceps and low hamstring activation correlates with greater incidence of noncontact ACL injuries. Therefore, female soccer athletes have a higher risk of suffering from this injury than males.

Landry, McKean, Hubley-Kozey, Stanish, and Deluzio (2007) studied the lower limb biomechanical and neuromuscular differences between male and female soccer players during unanticipated running and cutting maneuvers, and the relation to non-contact ACL tears. The study included 42 elite adolescent soccer athletes (21 male and 21 female). Each athlete completed an unanticipated straight-run and crosscut maneuver while being recorded using a kinematic video camera and while wearing electrodes that were placed by the researchers. During both maneuvers, the female athletes had greater lateral gastrocnemius activity, and demonstrated a mediolateral gastrocnemii imbalance that was not present in male players. The female subjects also had greater activation of quadriceps musculature (rectus femoris, vastus medialis, and vastus lateralis) during both maneuvers than male athletes. Other notable differences included female subjects having reduced hamstring activity, a reduced hip flexion moment, a reduced hip flexion angle, and an increased ankle eversion angle throughout stance compared with male players. Landry et al. (2007) concluded that these differences between genders are indicators of possible ACL injury risk factors in females. These findings provide insight into the

noncontact ACL injury gender bias and suggest that preventive training programs should focus on improving these factors in female athletes.

Harrison, Ford, Myer, and Hewett (2011) investigated gender differences in vertical ground reaction force and force loading rate in young athletes performing maximum, repeated vertical single-leg hops. This study consisted of 109 subjects (49 girls and 60 boys). All subjects were healthy, injury-free high school soccer or basketball athletes. All subjects performed vertical single leg-hops for 15 seconds on a portable force plate. The results showed that female athletes demonstrated significantly greater normalized vertical ground reaction force and a high force loading compared to male athletes. These findings indicate that the neuromuscular strategies used by female athletes during landing from a single-leg hop may be weak when landing with high-impact forces, predisposing them to noncontact injuries such as ACL tears.

Cowley, Ford, Myer, Kernozek, and Hewett (2006) sought to determine if female athletes show neuromuscular differences during landing and cutting tasks, and to examine the neuromuscular differences between the tasks and between the dominant and non-dominant sides. Thirty female high school athletes who listed either soccer or basketball as their only sport participated in this study. The mean age was 15 years, and mean years of experience in their sport was six years. All testing was performed on two force platforms. Subjects were asked to drop from a box onto the force plate. The second task was the cut, in which the athlete performed an immediate jump forward with both feet, landed on both feet, and followed with a side-step cut at an approximately 45 degree angle. It was observed that soccer athletes had greater ground reaction forces and a

decreased stance time during cutting. With these results and the great valgus movement noted during cutting and landing, it can be concluded that these athletes were more predisposed to noncontact injuries such as ACL tears. This study recommended that female soccer athletes incorporate more cutting and agility training, along with increasing quadriceps strength especially that of the vastus medialis muscle.

Developing Strength

Training of the musculature that stabilizes the knee joint before sports participation may decrease the relative injury incidence in female athletes (Hewett, Lindenfeld, Riccobene, & Noyes, 1999). Researchers have proposed that the strength ratios between the hamstring and quadriceps muscle groups are essential in maintaining ideal joint position and are a critical factor for avoiding injury during athletic movements such as running, pivoting, and cross-cutting, all which are primary movements found in soccer. Kim and Hong (2011) investigated the relationship between H/Q strength ratios and incidence of non-contact lower extremity injuries. A Biodex dynamometer was used to measure the hamstring and quadriceps strength of 41 female and 40 male NCAA Division III basketball and soccer athletes at 60 degrees per second. Non-contact injuries sustained by the athletes were tracked throughout their competitive seasons. An injury was defined as anything that prevented the athlete from participating in practice or competition for at least two weeks. During the seasons, a total of 67 non-contact injuries were reported. Ideal H/Q strength ratio was anything greater than 0.6. The results showed that 63.4% of right leg injuries and 67.1% of left leg injuries had an H/Q ratio of less than

0.6. It was concluded that H/Q strength imbalance was associated with and caused athletes to be susceptible to non-contact leg injuries.

In a similar study conducted by Devan, Pescatello, Faghri, and Anderson (2004), the influence of H/Q ratio and structural abnormalities on the prevalence of overuse knee injuries in female collegiate athletes was observed. The study included fifty-three NCAA Division I women's field hockey (n=23), soccer (n=20), and basketball (n=10) athletes. Each participant's H/Q ratio was determined from a preseason isokinetic test on a Biodex system at 60 degrees per second and 300 degrees per second. A goniometer was used to measure genu recurvatum and iliotibial band flexibility was assessed using the Ober test. During their training season, the athletes reported the following overuse knee injuries: iliotibial band friction syndrome, patellar tendinitis, patellofemoral syndrome, and pes anserine tendinitis. Athletes possessing lower H/Q ratios at 300 degrees per second ($p=.047$) and genu recurvatum experienced more overuse knee injuries than athletes without those abnormalities. It was determined that the presence of genu recurvatum and an H/Q ratio below normal range was associated with an increased prevalence of overuse knee injuries among female collegiate athletes. It was concluded that female athletes with muscle and structural abnormalities would be more predisposed to overuse knee injuries than athletes without these anomalies.

A study conducted by Holcomb, Rubley, Lee, and Guadagnoli (2007) examined the effects a strengthening protocol with a focus on hamstring strengthening on H/Q ratios, and its ability to prevent ACL injuries. The researchers described the role muscular balance plays in dynamic joint stabilization and the importance of H/Q strength

ratio in preventing knee injuries in sport. They stated that if the strength of the quadriceps significantly exceeds the strength of the hamstrings, then both the hamstring muscle and ACL become more susceptible to injury. They further stated that a training program that emphasizes hamstring strength will improve the H/Q ratio and decrease the likelihood of these injuries. They tested the ratio in both a conventional and functional manner. An H/Q conventional ratio is when both muscles are measured while working concentrically. A functional assessment compared the eccentric contraction of the hamstring to the concentric contraction of the quadriceps. Both assessment styles were tested in this study. Twelve female soccer athletes from a NCAA Division I university were participants in this study. An isokinetic machine (Kin-Com 125E Plus) was used to measure both the conventional and functional assessments at 240, 180, and 60 degrees per second. The strengthening protocol was implemented during off-season training. It was conducted four times per week for six weeks. The lower-body resistance training was modified to emphasize hamstring strengthening. The results showed a significant increase in H/Q ratio from functional pre-test to post-test. Conventional pre-test results compared to post-test results did not demonstrate significance. It was concluded that a strengthening program that emphasizes hamstring strengthening is recommended for ACL and hamstring injury prevention.

de Abreu and Denadai (2012) conducted a study that examined the effect of muscle fatigue on muscle imbalance dependence in male soccer athletes. Twenty-one male professional soccer athletes performed a pre-test and post-test isokinetic assessment of concentric/concentric H/Q and eccentric hamstring and concentric quadriceps

(EH/CQ) strength ratios of muscles at 60 and 180 degrees per second. Each participant performed exhaustive laboratory-based soccer specific exercises. The subjects were placed into two groups determined by their concentric H/Q ratio peak torque. The balanced group displayed a concentric H/Q ratio greater than 0.6, and the unbalanced group (UNBG) displayed a concentric H/Q ratio below 0.6. It was found that after fatigue the UNBG group displayed a further decrease in both concentric H/Q strength balance, and EH/CQ strength balance. Therefore, it was concluded that muscular strength balance may play a role in game-induced fatigue in professional soccer athletes, and could cause these athletes to be more susceptible to injury during late stages of the game.

Delextrat, Baker, Cohen, and Clarke (2011) conducted a similar study that examined the effect of a simulated soccer test on the functional (eccentric hamstring/concentric quadriceps) H/Q ratio in female soccer players. The subjects included 14 amateur players with an average age of 26 years, and each subject performed the modified Loughborough Intermittent Shuttle Test (LIST). Isokinetic strength of the hamstrings and quadriceps on the dominant and non-dominant legs at 120 degrees per second were performed before and immediately after the LIST. The eccentric hamstring-to-concentric quadriceps was calculated as the ratio of the peak eccentric torque of the hamstrings to the peak concentric torque of the quadriceps. The results showed a significant decrease in H/Q ratio peak torque in the dominant and non-dominant legs of the subjects after completing the modified LIST. The result shows that fatigue from activity caused a significant decrease in strength within the primary muscles needed for

performance, therefore placing the athletes at greater risk for injury late in game-style activity.

Validity of the Biodex Dynamometer

The Biodex dynamometer is a machine that uses isokinetic testing to measure strength. An isokinetic exercise uses the force applied by the subject as the resistance for the exercise while moving at a constant speed (Lind et al., 2005). A Biodex dynamometer has been documented in studies as a reliable and excellent tool to determine isokinetic strength and balance ratio of the hamstring and quadriceps muscles (Ferr-Morales, Alegre, Basco, & Aguado, 2014).

Ferr-Morales, Alegre, Basco, and Aguado (2014) assessed the test-retest reliability of isokinetic strength at 90 degrees per second and the isometric parameters for knee extensors. The knee extensor strength was measured twice, four to five days apart using a Biodex dynamometer in 40 subjects (12 men and 28 women). The protocols consisted of five concentric contractions at 90 degrees per second and five isometric contractions. The result measurement errors were small for all variables tested. For women, test retest reliability for isometric and isokinetic peak torque was very high. It was concluded that isokinetic values obtained at 90 degrees per second and isometric peak torque for knee extensors are highly repeatable with a standardized test protocol and can be used to detect real changes.

The purpose of the research conducted by Lind et al. (2005) was to assess the dependability of the Biodex dynamometer, as well as, compare the Biodex System 3 PRO and the Lido Active dynamometer. Thirteen participants, nine women and four men, were

tested. The mean age was 32 years and range was 18–55 years. It was noted that none of the participants had any injuries, decreased range of motion, or pain sensations in the hip, knee, hand, shoulder or elbow on the dominant side. The participants were asked to continue their normal physical activity levels during the study period. When testing the knee, subjects completed the exercises within a range of motion from zero degrees to 90 degrees of flexion. The results concluded that the isokinetic measurements obtained with a Biodex dynamometer are highly reliable. This provides information that the Biodex will be a good tool for collecting data in any study.

Developing Balance

In addition to strength, studies have shown that balance exercise programs improve proprioception which reduce the incidence of the injury in lower extremity dominant sports (Gioftsidou et al., 2012). Proprioception is the awareness of body segment positions and orientations, while balance is physical equilibrium. Therefore, balance exercises aim to improve and train proprioception pathways to become more effective under competitive circumstance, and prevent the occurrence of injury (Gioftsidou & Malliou, 2006). Hewett, Lindenfeld, Riccobene, and Noyes (1999) evaluated the effect of neuromuscular and balance training on the incidence of knee injury in female athletes. A total of 829 athletes participated in this study. All were high school athletes involved in either soccer, volleyball, or basketball. These sports were chosen due to the high level of jumping and cutting. The control group consisted of 463 girls and the intervention group consisted of 366 girls. All athletes were given a preseason questionnaire that included sport-specific information related to previous

injuries. Coaches of each intervention team were given an instructional video and training manual demonstrating a six-week preseason balance-training program. Knee injuries were reported throughout the preseasons of both the control and intervention teams. It was reported that the incidence of serious knee injury was 2.4 to 3.6 times higher in the control group. These results indicated that neuromuscular and balance training may decrease injury risk in female athletes.

Gioftsidou et al. (2012) compared two different balance-training programs. Thirty professional soccer players were randomly assigned to a group. Group A exercised with a frequency of six-times per week, for three weeks. Group B exercised with a frequency of three-times per week, for six weeks, and Group C (control) did not follow specific balance training. All subjects were pre-tested and post-tested using an electronic stability system and a wooden balance board. Both Group A and Group B significantly improved their balance ability, despite the different frequency of the programs. The researchers concluded that balance training can be applied in soccer players according to the demands of their training period, and benefits from such programs will result in improved proprioceptive ability.

A study conducted by Soderman et al. (2000) investigated whether training on a balance board could reduce the incidence of lower extremity injuries in female soccer players. In this study, seven teams (n = 121) were randomized into an intervention group and six teams (n = 100) into a control group and were followed during one outdoor season. Before and after the season muscle flexibility and balance/postural sway of the lower extremities were measured in the players. The players in the intervention group

performed a balance training program consisting of balance board training in addition to their standard soccer practice and games. Significantly more players from the control group than from the intervention group sustained new injuries during the time of this study. The researchers concluded that the balance program was a factor in the lower injury rates of the intervention group.

Validity of the Balance Error Scoring System (BESS)

According to Patterson et al. (2014) BESS “is a subjective balance assessment that involves tasks that range from simple static standing to conditions that alter peripheral sensory feedback.” It has been shown to be a valid and reliable method for measuring the static balance of an individual, however, it relies on the test administrator’s knowledge and clinical experience to properly score the test. Hunt et al. (2009) describe the BESS as having two parts, and each part having three trials. The three trials are composed of three standing conditions: a double-leg stance, non-dominant single leg stance, and tandem-leg stance. For part one the individual completes each stance on a firm, flat surface, and for part two on a foam surface. The subject stands with hands on hips and eyes closed. Each stance is held for a 20-second trial. The examiner scores the number of errors for each trial.

The purpose of an investigation by Patterson et al. (2014) was to compare subjective balance assessments such as the BESS with current mobile technology application and determine the reliability of the BESS. This study consisted of 21 non-athlete individuals, 14 women and seven men, with a mean age of 23 years. All subjects reported no pre-existing conditions that could affect their postural balance. Each subject

completed both the BESS and the SWAY balance mobile application test protocols. The SWAY balance test is a mobile device application that uses tri-axial accelerometer output to quantify postural sway. The test was administered using an Apple iPod touch with the SWAY software. It was determined that the BESS and the SWAY both provide means to objectively quantify postural balance and provide moderate to good reliability.

Hunt et al. (2009) studied the BESS to determine the percent variance associated with each component with the protocol, and to investigate the reliability of the BESS compared to the revised BESS. Seventy-eight high school football athletes with a mean age of 15 years were tested. Each subject completed the BESS according to the protocol. A second group of 144 high school football athletes with a mean age of 15 years completed what the study called the “revised” BESS. This test consisted of 4 conditions: single-leg and tandem-leg stance on both firm and foam surfaces. Completion of all four conditions was considered a trial. Each subject completed three trials. All subjects were videotaped and all scoring was completed after the testing while watching the recording. All tapes were scored twice by the primary investigator. It was determined that the use of the original BESS was more appropriate for estimation of postural stability.

Validity of the Biodex Balance System

The Biodex balance system may be used to measure a subject’s dynamic balance. As described by Arnold and Schmitz (1998), the Biodex balance system uses a circular platform that is free to move about the anterior-posterior and medial-lateral axis simultaneously. Arnold and Schmitz (1998) conducted research to establish normal patterns and relationships of stability using the Biodex stability system. The study

included 19 subjects, eight males, and 11 females. The average age was 24 years, and all subjects indicated that they had no history of lower extremity injuries before participation in the study. The reliability of the Biodex balance system was determined by the medial/lateral stability index, the anterior/posterior stability index, the overall stability index, and time-in-balance scores. The data suggested that the overall stability index was very closely related to the anterior/posterior stability index and received relatively small contributions from the medial/lateral stability index. Due to this small contribution, it is noted that anterior-posterior stability index should be considered compared to medial-lateral motions. Also, in order to better understand the cause of error, it would be more beneficial to test subjects using the anterior-posterior stability index and the medial-lateral stability index separately.

Cachupe, Shifflett, Kahanov, and Wughalter (2001) examined the reliability of measures of dynamic balance obtained by using the Biodex balance system. Twenty subjects were used, including 10 male and 10 female active adults engaged in weight-bearing sports. Dynamic balance was assessed using measures obtained from the Biodex balance system at a spring resistance level of two. Spring resistance levels range from one (least stable) to eight (most stable). Measures were obtained from 20-second trials during which participants were asked to maintain an upright standing position on their dominant limbs on the unstable surface of the Biodex balance system. The study's results agreed with those of Arnold and Schmitz (1998). The best results were found when the anterior-posterior stability index and the medial-lateral stability index were tested separately and not as an overall stability index.

Developing Agility

Along with strength and balance, agility is also important for sport performance and the decrease of potential injury risk (Lyle, Valero-Cuevas, Gregor, & Powers, 2015). However, factors of this motor skill that contribute to injury prevention still remain unclear. Havens and Sigward (2015) sought to identify whole body and/or joint mechanics that are related to completion of 45 and 90 degree angle cuts and determine which variables are predictors of performance and/or ACL injury risk. This study included 25 female soccer athletes. Each participant underwent a whole body and joint biomechanic analysis while performing two sidestep cutting maneuvers at 45 and 90 degrees. Researchers found that during both movements the subjects presented with muscle movement and weakness that were predictive biomechanics of high injury risk, particularly non-contact ACL injuries. It was concluded that these results indicate a need for ACL injury prevention programs and the researchers recommend that these programs focus on appropriate performance of cutting maneuvers.

Dempsey et al. (2007) investigated the effect of modifying sidestep cutting technique on knee loads and the impact the change would have on the risk of noncontact ACL injury in male athletes. The study included 15 male subjects that performed what they considered their normal sidestep cutting technique and nine male subjects that performed a modified sidestep cutting technique as instructed by the researchers. A force platform and motion-analysis system were used to record ground-reaction forces and track the trajectories of markers on the subjects. It was concluded that normal sidestep cutting techniques cause significant loads at the knee joint of the subjects. The techniques

produced higher valgus and internal rotation moments at the knee, and may place the athlete at higher risk of injury. The subjects that were trained and performed the modified sidestep cutting avoided such body positions, and may have reduced risk of noncontact ACL injuries. It was recommended that injury prevention programs should include modified agility and cutting techniques.

Validity of the 5-Dot Agility Test

The 5-dot agility test is a well-known and popular test in the United States (Gorman, 2012). While being timed, the athlete continuously completes five hopping exercises six times in the following sequence: up and back, right foot, left foot, both feet, and turn around. The testing area is set-up in a 60x90 cm (2x3 ft.) rectangular shape with five dots or circles placed 10 cm (4inches) apart (Everett, 2008). There is little information in the literature regarding the validity of this test, however, it is used by many strength and conditioning professionals as a tool to assess and increase patient agility and performance.

Gorman (2012) assessed the 5-dot agility test using an OptoJump advance training and testing system. OptoJump is an advanced testing system that quickly and easily assesses body mechanics while an athlete is in motion. The program presents real-time feedback in three formats: video, graphical and numerical. Researchers at Bigger Faster Strong Headquarters tested the 5-dot agility test using the OptoJump system. Results showed that the 5-dot agility test effectively measured an athlete's ability to accelerate, decelerate, and change direction. Therefore, they concluded that it can be used as both an agility testing and training tool for athletes.

The FIFA 11+

A warm-up is generally used to prepare athletes for participation in a sporting event. Warm-up programs usually consist of mild or moderate exercises that are geared toward enhancing the performance of the athlete. The FIFA 11+ warm-up program is a soccer specific warm-up that includes running, strength, plyometric, balance, and agility components (Daneshjoo, Mokhtar, Rahnama & Yusof, 2013). According to FIFA's official website: "the 11+ program reduces injuries among male and female soccer players ages 14 and older." The current research has primarily focused on the effects this program has on male soccer athletes. Bizzini et al. (2013) examined the post-exercise effects of the FIFA 11+ on various physical performance parameters. They wanted to determine if this program was an appropriate warm-up for soccer players. The subjects in the study were twenty amateur male soccer players with a mean age of 25.5 years. Each participant was tested before and after the completion of the FIFA 11+ program. The test included timed 20-meter sprints, vertical jump, isometric maximal voluntary contraction (MVC), rate of force development (RFD), and the star excursion balance test. Oxygen uptake, lactate and core temperature were also measured. Increases in all functions were found from pre-test to post-test, except MVC, and RFD. Resting oxygen uptake and core temperature increased as well. From these results, Bizzini et al. (2013) determined that the FIFA 11+ program could be considered an appropriate warm-up to promote functional improvements in male soccer athletes.

Brito et al. (2010) choose to evaluate whether the FIFA 11+ improved isokinetic strength of the knee extensor and flexor muscles in sub-elite male soccer players.

Subjects included twenty male soccer players with a mean age of 22.3 years. Each participant performed the FIFA 11+ exercises three times a week for 10 weeks. Isokinetic measurements were conducted concentrically (CON) on both muscle groups at 60 and 180 degrees per second, and eccentrically (ECC) at 30 degrees per second. Both the dominant and non-dominant limbs were tested and the peak torque (PT) and H/Q ratios were recorded. Results showed a significant increase in non-dominant CON and ECC hamstring PT at all speeds. Significant increases were also found in dominant CON and ECC PT for both the quadriceps and hamstrings at all speeds. Although no changes in H/Q ratio were indicated in either limb, the researchers stated that the study showed the FIFA 11+ program may improve the isokinetic strength within male soccer athletes.

Daneshjoo et al. (2013) chose to compare the effect of the FIFA 11+ and HarmoKnee injury prevention programs on knee strength of young professional male soccer players. Thirty-six soccer players with a mean age of 18.9 years were used as subjects. The subjects were divided equally into three groups: FIFA 11+, HarmoKnee, and control group. The two experimental groups each completed 24 training sessions. Hamstring and quadriceps strength was measured using the Biodex System 3 and knee flexion and extension was measured at 30, 60, and 90 degrees per second. Subjects who performed the FIFA 11+ increased quadriceps and hamstring strength in both legs. The HarmoKnee group showed higher increases in quadriceps strength compared to the FIFA 11+, but did not demonstrate improvements in hamstring strength. It was concluded that both warm-up programs improve quadriceps strength, but only the FIFA 11+ had positive effects on the hamstrings.

Saho et al. (2011) also compared the FIFA 11+ to another program, however, it was compared to the original FIFA 11 which was first developed before the FIFA 11+. The FIFA 11+ incorporates more plyometric training than the original FIFA 11. Subjects included 182 male collegiate soccer players of the first division of a Japanese soccer league. Subjects were divided into three groups: the FIFA 11 (n=62), the FIFA 11+ (n=60), and control (n=59). All participants were evaluated for physical fitness and protocols were conducted once or twice a week for 6 months. Outcome measures included injury incidence rates during games and training. Using several field tests (sprint, pro-agility, bounding, and balance), each subject's physical fitness level was evaluated prior to and after the training. The results indicated that the rate of injury during play was significantly lower in both training groups than in the control group. Pro-agility time was significantly decreased in both training groups compared to the control. Balance ability improved significantly only in the FIFA 11+ group. It was concluded that the FIFA 11 and the FIFA 11+ were effective in injury prevention and physical fitness improvement for male soccer athletes.

Only two studies were found that conducted research involving the FIFA 11+ program and female soccer athletes. Soligard et al. (2010) sought to assess the ability of the FIFA 11+ to prevent injuries in female youth soccer athletes. This study involved 1,055 female athletes, ages ranging from 13-17 years old, from 65 different club soccer teams that completed the FIFA 11+. The program was conducted at least two times per week for a total of two months. The injuries were tracked by one physical therapist and one medical student. They conducted telephone interviews with the athletes before and

after the program. Researchers did not attend training sessions and compliance of the teams to complete the FIFA 11+ program was reported weekly by the teams' coaches. It was found that the players on teams who completed the FIFA 11+ program at least 1.5 times per week experienced a 45% reduction in overall risk of injury compared with the players whose teams reported lower compliance.

Myklebust et al. (2008) also examined the effect of the FIFA 11+ on injury reduction in female youth soccer athletes. This study included 1,892 female soccer players that completed the FIFA 11+ program and 837 were part of the control group. Their ages ranged from 13-17 years and all were involved in youth soccer club teams. Primary outcome was defined as any injury to the lower extremity, while secondary outcomes as any injury to any other body part. Overuse injuries were also included. Any injuries that were reported after the completion of the first training session using the FIFA 11+ were included in this study. The results of this study did show a reduction in lower extremity and overuse injuries, though it did not reach significance.

Conclusion

Soccer participation leads to a substantial number of musculoskeletal injuries. Soccer athletes must possess proper lower extremity muscle strength, and the ability to maintain balance while running and quickly changing direction. The inability to properly execute these techniques can lead to non-contact, lower extremity injuries. According to the literature, injury prevention programs should focus on restoring H/Q muscle ratios, improving balance, and developing proper cutting technique (Gioftsidou & Malliou, 2006).

The FIFA 11+ warm-up program is a soccer specific warm-up that includes running, strength, plyometric, balance, and agility components (Daneshjoo, Mokhtar, Rahnama, & Yusof, 2013). The current research has primarily focused on the effects this program has on male soccer athletes. Studies have found that the FIFA 11+ was successful and improved hamstring and quadriceps strength and imbalances, advanced subject's balance ability, and showed soccer specific functional improvements such as running and cutting. Therefore, it was concluded that the intervention of this program would in fact be effective in preventing lower extremity injuries within soccer athletes (Myklebust et al., 2008; Saho et al., 2011; Daneshjoo et al., 2013; Brito et al., 2010).

Chapter 3

Methods and Procedures

Introduction

The FIFA 11+ is a 20 minute warm-up program designed to decrease injury prevalence within soccer athletes by increasing the players' strength, balance, and agility. There are various amounts of research conducted on the program's success within the male population, however, little testing has been conducted within the female population. The current research assessed the claim of the FIFA 11+ to decrease injury and tested the effects of the program within a female population.

Participants

This study was conducted at a southeast NCAA Division I school, and methodology was approved by the institution's Institutional Review Board. The participants in this study included thirteen undergraduate collegiate female soccer athletes, ages ranging from 18 to 23 years. All participants were required to complete an informed consent form prior to the pre-test. Permission to use the soccer athletes from this institution was obtained from the team's head coach and assistant coach. All subjects completed pre-testing prior to completion of the program protocol, and post-testing after the eight-week protocol. All subjects completed the FIFA 11+ Warm Up Program, three times per week over an eight-week period. Instruction of the exercises in the program was carried out by the team's coaching staff. Participants of this study included all soccer field positions: two forwards, four midfielders, four defenders and three goalkeepers. Participants were excluded from this study if any of the following applied: indication of

current injury that could possibly skew data collected, or the inability to efficiently carry out the exercises outlined in the FIFA 11+ protocol.

Research Design

The research design used in this study was a quasi-experimental design to determine if there was a cause and effect relationship between the pre and post-testing data. There was not a control group utilized in this study. The independent variables in this study were the progressions and variations of the exercises within the FIFA 11+ program. The dependent variables included the strength, balance, and functional agility of the participants. The Statistical Package for the Social Sciences (SPSS) program was used to analyze all data. All data were analyzed using a paired-sample *t* test.

Procedures

Participants reported to the testing facility where they signed an agreement to participate and completed a demographic questionnaire before they engaged in data collection. Data collection was performed by the primary researcher, the research advisor, and volunteers who were undergraduate athletic training students enrolled at the university. The role of the volunteers was to assist the researchers in managing the subjects and collecting data within their assigned stations. All volunteers completed training sessions prior to data collection to ensure proper administration of the test.

Subjects warmed up on a stationary bike for ten minutes. Parameters of the bike were determined by the subject. In order to test the strength of each subject, the Biodex System 3 dynamometer was used. The BESS was used to assess static balance, the Biodex balance system was used for single leg dynamic balance, and the 5-dot agility

test was used for functional agility. Each test was performed bilaterally. Each subject's dominant leg was indicated from their demographic questionnaire.

Participants were informed of the testing protocol prior to completion of the test. Demonstrations were provided and an opportunity for questions was given prior to data collection. The first test conducted was the Biodex balance system followed by completion of the BESS. Subjects were given a two minute rest period before completion of the 5-dot agility test. The primary researcher demonstrated the procedures of the 5-dot agility test prior to all data collection. The researcher counted the number of repetitions out loud for the subjects and timed the test with a standard stop watch. The last test conducted was the Biodex dynamometer. The testing protocol was carried out by the research advisor. Instruction regarding the testing procedures were vocally given to the subjects by the research advisor. Subjects were encouraged throughout the testing. Speeds tested included 90, 180, and 300 degrees per second. All tests were performed bilaterally.

Pre-testing was conducted prior to the team's spring season training and the start of the FIFA 11+ program. Instruction of the FIFA 11+ program was carried out by the team's coaching staff, and was completed three times per week. Eight weeks after the pre-test data collection, post-test data were collected. The same procedures were followed when collecting the post-test data. All data were stored in the athletic training main office of the university within locked cabinets. Only the researchers had access to the data. Identification numbers were used in place of subject names.

Chapter 4

Results

This study consisted of thirteen collegiate female soccer athletes. All participants completed the FIFA 11+ Warm Up Program three times per week, over an eight week period. Prior to completing the protocol, subjects underwent pre-testing to assess their H/Q strength ratio, static and dynamic balance, and agility. Post-testing was conducted after completion of the FIFA 11+ program. Results were analyzed using SPSS. The purpose of this study was to determine the effect of the FIFA 11+ warm up program in female collegiate soccer athletes. A paired-sample *t* test was calculated to compare pre and post-test data. Although not all outcomes produced statistical significance, all means showed a trend toward improvement. Significant values included H/Q ratio of the non-dominant leg at 90 degrees per second and agility time.

H/Q Strength Ratios: 90, 180 & 300 degrees per second

As seen in Table 1, the H/Q strength ratio of the subjects' non-dominant leg at 90 degrees per second presented statistical significance ($p=.051$). This supports the hypothesis that the H/Q ratio of the subjects would improve after the completion of the FIFA 11+ protocol. Although the H/Q strength ratio of the dominant leg at 90 degrees per second did not reach significant values, the post-testing mean showed a trend toward improvement. There were no statistically significant improvements in the subjects' dominant or non-dominant H/Q strength ratios at 180 degrees per second. Both the dominant and non-dominant legs of the subjects showed a trend toward improvement. The same was true for the H/Q strength ratio values at 300 degrees per second.

Table 1

| | | Paired Samples Test | | | |
|--------|-----------------------------------|---|--------|----|-----------------|
| | | Paired Differences | | | |
| | | 95% Confidence Interval of the Difference | | | Sig. (2-tailed) |
| | | Upper | t | df | |
| Pair 1 | PRE_HQ90_D - POST_HQ90_D | 4.9376 | -.107 | 12 | .917 |
| Pair 2 | PRE_HQ90_ND - POST_HQ90_ND | .0201 | -2.165 | 12 | .051 |
| Pair 3 | PRE_HQ180_D - POST_HQ180_D | 3.5277 | -.390 | 12 | .703 |
| Pair 4 | PRE_HQ_180_ND - POST_HQ180_ND | 1.3456 | -1.716 | 12 | .112 |
| Pair 5 | PRE_HQ_300_D - POST_HQ_300_D | 6.4791 | .853 | 12 | .410 |
| Pair 6 | PRE_HQ_300_ND - POST_HQ_300_ND | 5.4471 | -1.038 | 12 | .320 |

Balance: Static and Dynamic

Static balance was determined by a decrease in errors that occurred during the BESS. For the single leg portion of the BESS the subject's non-dominant leg was tested. Results from static balance did not show a significant decrease in balance errors, however, as seen in Table 2, the mean average of the post-test did show a trend toward improvement.

For dynamic balance, overall single leg stability, anterior/posterior index, and medial/lateral index data were observed. Results of the independent *t* test between pre and post-testing showed no significant difference for any of the above variables in the

subjects' dominant or non-dominant legs. However, as seen in Table 2, all results did show a trend toward dynamic balance improvement for all variables.

Agility

The agility performance of the participants in this study was determined by a decreased time when performing the 5-dot agility test. As seen in Table 2, the results of the independent *t* test between pre and post-testing showed a significant decrease in post-test times ($p=.001$). This result supports the hypothesis that completion of the FIFA 11+ warm up program would improve the agility performance of the subjects.

Table 2

| | Paired Differences | t | df | Sig. (2-tailed) | |
|--------|--|--------|--------|-----------------|---|
| | | | | | 95% Confidence Interval of the Difference |
| | | | | | Upper |
| Pair 1 | PRE_Static - POST_Static | 4.1976 | .681 | 12 | .509 |
| Pair 2 | PRE_Dynamic_D - POST_Dynamic_D | .5517 | 1.315 | 12 | .213 |
| Pair 3 | PRE_Dynamic_D_AP - POST_Dynamic_D_ML | .5033 | 1.262 | 12 | .231 |
| Pair 4 | PRE_Dynamic_D_ML - POST_Dynamic_D_ML | .4257 | 1.050 | 12 | .314 |
| Pair 5 | PRE_Dynamic_ND - POST_Dynamic_ND | .2817 | -.391 | 12 | .703 |
| Pair 6 | PRE_Dynamic_ND_AP - POST_Dynamic_ND_AP | .1509 | -1.043 | 12 | .318 |
| Pair 7 | PRE_Dynamic_ND_ML - POST_Dynamic_ND_ML | .2547 | .299 | 12 | .770 |
| Pair 8 | PRE_AgilityTime - POST_AgilityTime | .94671 | 4.580 | 12 | .001 |

Chapter 5

Discussion

The purpose of this study was to examine the effect of the FIFA 11+ Warm Up Program on the development of strength, static and dynamic balance, and agility in female collegiate soccer athletes. During the participants' spring season the FIFA 11+ program was implemented as their warm up three times per week, for eight weeks. In order to determine the program's effect on the subjects' performance, pre and post-tests were conducted which assessed H/Q strength ratios, static and dynamic balance, and agility. The key difference in this study, compared to previous studies, was investigation of the program's effects using female subjects.

Previous research has primarily tested the effects of this program in male subjects (Bizzini et al., 2013; Brito et al., 2010; Daneshjoo et al., 2013). However, when it comes to soccer injury risk, females are more predisposed to injury (Havens & Sigward, 2015). Research has indicated that correcting H/Q strength ratios, increasing both static and dynamic balance, and improving agility performance will decrease the risk of injury in female soccer athletes (Gioftsidou & Malliou, 2006; Hewett, Lindenfeld, Riccobene, & Noyes 1999; Lyle, Valero-Cuevas, Gregor, & Powers, 2015).

Due to the lack of research involving female subjects, this study examined the effect of the FIFA 11+ Warm Up Program in a female collegiate population. Although H/Q strength ratios in the non-dominant leg at 90 degrees per second and agility performance were the only variables with significantly higher results, all variable means showed a trend toward improvement.

One factor that might explain why some results of this study did not reach significance, could be the low number of subjects and loss of subjects due to injury. Failure to reach significance may have also been impacted by the inability of the researcher to observe all practice sessions where the FIFA 11+ was performed. More significant results may have been achieved if the intervention of the FIFA 11+ program was compared to a control group of equal skill to the participants used in this study. Furthermore, a longer time period of intervention, 10-12 weeks, versus the eight weeks used in this study, could have led to more significant results.

Other limitations noted in this study include the use of different student volunteers for the pre-test and post-test data. The only test that was conducted by student volunteers was the BESS. The same student was unable to conduct the post-test collection. Although all volunteers underwent the same training prior to data collection, it cannot be determined that they conducted the testing in exactly the same fashion.

Recommendations for Future Research

Based on the findings of this study, the following are recommendations for future research:

1. Future research should be conducted with a larger sample size than was used in this study (n=13).
2. Future research should be conducted using a control group who train at the same level as the intervention group.
3. The primary researcher of future research should instruct participants through the FIFA 11+ intervention.

4. Future research should utilize a comparison of the effects of this program between female and male soccer athletes.
5. Future research should collect injury data throughout the season during which the study is conducted.
6. All pre and post-test data collected in future research should be performed by the same individual.

Conclusion

The developers of the FIFA 11+ program claim that if it is conducted at least three times per week, it will reduce the likelihood of injury within female and male soccer athletes, 14 years and older (Bizzini et al., 2013; Brito et al., 2010). Abundant research has validated this claim for male soccer athletes, however, very little investigation regarding its effect in the female population exists. This study sought to determine if the claim of this program held true for female soccer athletes, since female athletes have a higher risk of injury (Kim & Hung, 2011; Gioftsidou et al., 2012). As noted in the literature review, in order to reduce the likelihood of female soccer injuries, a prevention program should focus on restoring H/Q strength ratios, the improvement of balance, and the performance of functional agility maneuvers (Hewett, Lindenfeld, Riccobene, & Noyes, 1999; Gioftsidou & Malliou, 2006). This study determined that the FIFA 11+ program is an appropriate warm up for female soccer athletes, and showed a trend toward improved performance variables for this population, however, more research is needed to determine its exact effect in female athletes.

Appendices

Appendix A

IRB Form

IRB #

TO BE COMPLETED BY SPAR

Winthrop University

REQUEST FOR REVIEW OF RESEARCH INVOLVING HUMAN SUBJECTS

Institutional Review Board

| | |
|---|---|
| <p>RESEARCHER of RECORD: Stacey O'Neill COLLEGE/DEPARTMENT: [REDACTED] PHONE NUMBER: HOME [REDACTED] WORK: EMAIL: [REDACTED] CELL PHONE: [REDACTED] ADDRESS: [REDACTED]</p> <p>STATUS: <input type="checkbox"/> Faculty or Staff</p> <p><u>(If a student, complete faculty advisor section)</u></p> <p><input checked="" type="checkbox"/> Graduate Student <input type="checkbox"/> Undergraduate Student</p> | <p>CO-RESEARCHERS:</p> <p>FACULTY ADVISOR: [REDACTED] ADVISOR PHONE: HOME: WORK: EMAIL: [REDACTED] CELL PHONE: ADDRESS:</p> |
| <p>TITLE OF RESEARCH: The effects of the FIFA 11+ warm up program in female youth soccer athletes</p> | |
| <p>DATES OF THE RESEARCH PROJECT:</p> <p>Approval Requested for Start Date: 10/06/2015 (The requested start date should be at least 2 weeks after the next scheduled meeting of the IRB)</p> <p>End Date: 6/1/2016 (Maximum of one year; must be renewed annually)</p> | |
| <p>IS THIS RESEARCH BEING FUNDED BY RESEARCH GRANT?</p> <p><input type="checkbox"/> YES; Sponsor: <input type="checkbox"/> Funding Applied for; Sponsor: <input checked="" type="checkbox"/> NO</p> | |

| | |
|----|---|
| 1. | <p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Is this activity being carried out by student as a classroom assignment to be reviewed by the faculty member.</p> <p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Will the information gathered or developed in this activity be used in a presentation or publication outside of the classroom?</p> <p>If you checked yes to both questions above, please explain how the information will be used outside of the classroom: submission of research for publication in academic journal.</p> |
| 2. | <p>INDICATE THE TYPES OF MEMBERS OF THE RESEARCH TEAM WHO WILL HAVE DIRECT CONTACT WITH HUMAN SUBJECTS:</p> <p><input checked="" type="checkbox"/> FACULTY MEMBER</p> <p><input type="checkbox"/> STAFF MEMBER</p> <p><input checked="" type="checkbox"/> UNDERGRADUATE STUDENT</p> <p><input checked="" type="checkbox"/> GRADUATE STUDENT</p> <p><input type="checkbox"/> OTHER; SPECIFY:</p> |
| 3. | <p>A. BRIEFLY DESCRIBE THE PURPOSE OF THE RESEARCH IN NON-TECHNICAL LANGUAGE: The purpose of this study is to obtain information to determine whether or not the FIFA 11+ program improves the skills of female soccer players.</p> <p>B. DESCRIBE RESEARCH PROTOCOL OR METHODOLOGY TO BE USED: ██████████ testing days. On these days the girls will be asked to complete 4 exercise test. Two of the test will test balance, one will test strength, and the other will test functional agility. The girls will be split into two group. Group 1 will also be asked to complete the FIFA 11+ warm up program 3 times a week for 12 weeks. Group 2, will not complete the FIFA 11+ program and only have to complete the 3 testing days.</p> |
| 4. | <p>EXPLAIN BRIEFLY BUT COMPLETELY WHAT TASKS OR ACTIVITIES THE SUBJECTS IN THIS RESEARCH WILL BE DOING [If a survey/questionnaire is to be used, state how many questions will be asked and the expected time to complete the survey]: All subjects will complete three separate testing sessions. The test include: Biodex Dyanometer test for strength, Biodex Balance System test for dynamic balance, the Balance Error Scoring test for static balance, and a 5-dot agility test for functional agility. All subjects in group 1 will also complete the FIFA 11+ protocol 3 times per week for 12 weeks.</p> |
| 5. | <p>DESCRIBE SUBJECTS FOR THIS RESEARCH, INCLUDING A STATEMENT OF WHO WILL BE RECRUITED AND THE</p> |

| | | | | | | | | | | | | | | | | | | | |
|---|---|--|--|--|------------------------------|--|------------------------------|--|------------------------------|--|------------------------------|--|------------------------------|--|---|-----------------------------|--------|------------------------------|--|
| | <p>ANTICIPATED POPULATION SIZE: The participants that will be involved with this study will include female adolescent soccer players, ages ranging from 14-18 years old. The potential number of participants is approximately 44 subjects.</p> | | | | | | | | | | | | | | | | | | |
| | <p>DO YOUR SUBJECTS INCLUDE ANY OF THE FOLLOWING:</p> <table border="0"> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td rowspan="6"> Infants and children younger than 7 years? Institutionalized mentally impaired people? Students enrolled in your own classes? Students enrolled at Winthrop University? Prisoners? Other special populations? Specify - </td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> </table> | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | Infants and children younger than 7 years? Institutionalized mentally impaired people? Students enrolled in your own classes? Students enrolled at Winthrop University? Prisoners? Other special populations? Specify - | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | | | | |
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| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | | | | | | | | | | | | | | | | | |
| 6. | <p>DESCRIBE HOW SUBJECTS WILL BE RECRUITED FOR THIS RESEARCH: Female soccer athletes from area high schools will be recruited for participation. I will seek interest of the coaches of these teams. With their and the schools approval, I will open the opportunity to participate in the research to their soccer athletes.</p> | | | | | | | | | | | | | | | | | | |
| 7. | <p>HOW WILL YOU ASSURE THAT PARTICIPATION OF THE SUBJECTS IS VOLUNTARY? Only athletes who chose to part-take in the study will participate. I will make it clear that anyone can drop out of the study, at any time, if needed.</p> | | | | | | | | | | | | | | | | | | |
| 8a. | <p>CAN THE HUMAN SUBJECT BE DIRECTLY IDENTIFIED BY: <i>(For any responses of "yes" indicate in the space provided how the subject's privacy will be protected.)</i></p> <table border="0"> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> <td rowspan="6"> Name on Response form; Photograph: Television/VCR/DVD tapes: Audiotape: Coded Research Forms: Detailed Biographical Data: Informed Consent, Assent or Parental Permission forms: The subjects name will be placed on the consent forms, however, these forms with be kept with the ID code sheet in a separate cabinet and all other forms will only contain the subjects ID number. </td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> <tr> <td><input checked="" type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> <td rowspan="2"> Other: </td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input checked="" type="checkbox"/> No</td> </tr> </table> | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | Name on Response form; Photograph: Television/VCR/DVD tapes: Audiotape: Coded Research Forms: Detailed Biographical Data: Informed Consent, Assent or Parental Permission forms: The subjects name will be placed on the consent forms, however, these forms with be kept with the ID code sheet in a separate cabinet and all other forms will only contain the subjects ID number. | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | Other: | <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | Name on Response form; Photograph: Television/VCR/DVD tapes: Audiotape: Coded Research Forms: Detailed Biographical Data: Informed Consent, Assent or Parental Permission forms: The subjects name will be placed on the consent forms, however, these forms with be kept with the ID code sheet in a separate cabinet and all other forms will only contain the subjects ID number. | | | | | | | | | | | | | | | | | |
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| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | Other: | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | | | | | | | | | | | | | | | | | | |

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| | <p>asked to sign a consent form prior to participation. All subjects under the age of 18 years old will be asked to be accompanied by a parent or guardian at test dates. Parents will be asked to sign a consent form for any subjects under the age of 18 years old. All consent forms that will be used are attached.</p> |
| 11b | <p>WAIVER OF SIGNED INFORMED CONSENT REQUIREMENT</p> <p>TO REQUEST A WAIVER OF A SIGNED INFORMED CONSENT, COMPLETE THE FOLLOWING:</p> <p><input type="checkbox"/> The only record linking the subject and the research would be the consent document, and the principal risk will be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern. Section 46.117(c)1</p> <p><input type="checkbox"/> The research presents no more than minimal risk of harm to the subjects, and involves no procedures, for which written consent is normally required outside of the research context. Section 46.117(c)2</p> <p><input type="checkbox"/> The research or demonstration project is to be conducted by or subject to the approval of state or local government officials and is designed to study, evaluate, or otherwise examine (i)public benefit or service programs; (ii)procedures for obtaining benefits or services under these programs; (iii)possible changes in or alternatives to those programs or procedures; or (iv)possible changes in methods or levels of payment for benefits or services under those programs; and the research could not practicably be carried out without the waiver or alteration. Section 46.116(c)</p> <p><input checked="" type="checkbox"/> The research involves no more than minimal risk to the subjects, the waiver will not adversely affect the rights and welfare of the subjects, the research could not practicably be carried out without the waiver, and whenever appropriate, the subjects will be provided with additional pertinent information after participation. Section 46.116(d)</p> <p>In cases where the documentation requirement is waived, the IRB may require the investigator to provide subjects with a written statement regarding the research.</p> |
| 12. | <p>STORAGE AND DISPOSAL OF DATA AND OTHER RESEARCH MATERIALS:</p> <p>A. How and where will the data and other research material be stored until no longer needed? Files will be stored in locked file cabinets located in the Winthrop University Athletic Training Room until they are no longer needed.</p> <p>B. When will the disposal of data and research materials take place? The data files and research will be disposed five years after the conclusion of the research.</p> |

| | | | | | | | | | | | | | | | |
|-------------------------------------|---|-------------------------------------|--|-------------------------------------|----------------------------|-------------------------------------|--|--------------------------|---|-------------------------------------|--|--------------------------|--|-------------------------------------|--------------------------------------|
| | <p><i>At a minimum, investigators must maintain research records for at least three (3) years after completion of the research. All records must be accessible for inspection and copying by authorized representatives of the IRB, any federal department or agency supporting the research, and sponsor, if any. (Source: 45CFR46.115) If the Principal Investigator is a student, then the faculty advisor will be responsible for the record retention. If you are a member of a professional association or society, you may be required by their practices to keep records longer than 3 years.</i></p> <p>C. How will data and research materials be disposed? All data files and research will be shredded and thrown away after the conclusion of usage or the minimum time of required to maintain records is surpassed.</p> | | | | | | | | | | | | | | |
| <p>13.</p> | <p>INDICATE ON THE CHECK LIST BELOW, ANY DOCUMENTS THAT APPLY TO YOUR RESEARCH AND ATTACH TO THIS PROTOCOL A COPY OF THE APPLICABLE DOCUMENT.</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>SURVEY INSTRUMENT AND/OR INTERVIEW QUESTIONNAIRE</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>INFORMED CONSENT AGREEMENT</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>PARENTAL OR GUARDIAN PERMISSION FOR A MINOR CHILD TO PARTICIPATE IN A RESEARCH STUDY</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>ASSENT TO PARTICIPATE IN A RESEARCH STUDY (AGES 7-14 YEARS)</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>ASSENT TO PARTICIPATE IN A RESEARCH STUDY (AGES 15 - 17 YEARS)</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>COPIES OF ANY OTHER MAIL TO BE DELIVERED TO RESPONDENTS OR SUBJECTS (E.G. COVER LETTERS.</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>SCRIPTS OF VERBAL INSTRUCTIONS, ETC.</td> </tr> </table> | <input checked="" type="checkbox"/> | SURVEY INSTRUMENT AND/OR INTERVIEW QUESTIONNAIRE | <input checked="" type="checkbox"/> | INFORMED CONSENT AGREEMENT | <input checked="" type="checkbox"/> | PARENTAL OR GUARDIAN PERMISSION FOR A MINOR CHILD TO PARTICIPATE IN A RESEARCH STUDY | <input type="checkbox"/> | ASSENT TO PARTICIPATE IN A RESEARCH STUDY (AGES 7-14 YEARS) | <input checked="" type="checkbox"/> | ASSENT TO PARTICIPATE IN A RESEARCH STUDY (AGES 15 - 17 YEARS) | <input type="checkbox"/> | COPIES OF ANY OTHER MAIL TO BE DELIVERED TO RESPONDENTS OR SUBJECTS (E.G. COVER LETTERS. | <input checked="" type="checkbox"/> | SCRIPTS OF VERBAL INSTRUCTIONS, ETC. |
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| <input checked="" type="checkbox"/> | INFORMED CONSENT AGREEMENT | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | PARENTAL OR GUARDIAN PERMISSION FOR A MINOR CHILD TO PARTICIPATE IN A RESEARCH STUDY | | | | | | | | | | | | | | |
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| <input type="checkbox"/> | COPIES OF ANY OTHER MAIL TO BE DELIVERED TO RESPONDENTS OR SUBJECTS (E.G. COVER LETTERS. | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | SCRIPTS OF VERBAL INSTRUCTIONS, ETC. | | | | | | | | | | | | | | |
| <p>14.</p> | <p style="text-align: center;"><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>DO YOU CONSIDER THIS RESEARCH EXEMPT FROM REVIEW BY THE HUMAN SUBJECTS COMMITTEE? IF YES, Please check the reason for exemption from the list below:</p> | | | | | | | | | | | | | | |
| <p>a.</p> | <p style="text-align: center;"><input type="checkbox"/></p> <p>Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (a) research on regular and special education instructional strategies; or (b) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods [45CFR46(b)(1)]</p> | | | | | | | | | | | | | | |

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| b. | <input type="checkbox"/> | <p>Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement) survey procedures, interview procedures or observation of public behavior, unless (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the subject at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability or reputation. [45CFR46(b)(2)]</p> <p>Research involving children (subjects that have not attained the age of 18 years) is not exempt under this category unless the research involves only the observation of public behavior and the researchers do not participate or impact the activities being observed. [45CFR46.401(b)]</p> |
| c. | <input type="checkbox"/> | <p>Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior if (a) the human subjects are elected or appointed public officials or candidates for public office; or (b) federal statute(s) without exemption that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter. [45CFR46(b)(3)]</p> |
| d. | <input type="checkbox"/> | <p>Research involving the collection study of existing data, documents, records, pathological specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. [45CFR46(b)(4)]</p> |
| e. | <input type="checkbox"/> | <p>Research and demonstration projects which are conducted by or subject to the approval of a Federal department or agency heads, and which are designed to study, evaluate, or otherwise examine; (a) public benefit or service programs of Federal programs; (b) procedures for obtaining benefits or services under those Federal programs; (c) possible changes in methods or alternatives to those Federal</p> |

| | | |
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| | | programs or procedures; or (d) possible changes in methods or levels of payment for benefits or services under those Federal programs. [45CFR46(b)(5)] |
| f. | <input type="checkbox"/> | Taste and food quality evaluation and consumer acceptance studies, (a) if wholesome foods without additives are consumed; or (b) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture. [45CFR46(b)(6)] |

Certifications

By my signature below, I certify that each of the named co-researchers has accepted his/her role in this study. I agree to not begin any research activity on this study until written approval by the IRB has been received. I agree to a continuing exchange of information with the Institutional Review Board (IRB). I agree to obtain IRB approval before making any changes or additions to the project. I will provide progress reports at least annually, or as requested. I agree to report promptly to the IRB all unanticipated problems or serious adverse events involving risk to human subjects. A copy of the informed consent will be given to each subject and the signed original will be retained in my files, unless a waiver of a signed informed consent has been granted.

I further certify that I have successfully completed the following Human Subjects Training Course:

- CITI – Biomedical Research Investigator
- CITI – Social and Behavioral Research Investigator
- CITI – Undergraduate Researcher
- CITI – IRB Member

[Handwritten Signature]

[Handwritten Signature]

5/18/15

Signature of Researcher

Date

By my signature below, I certify that I have reviewed this research study and agree to counsel the student researcher in all aspects of the research study.

I further certify that I have successfully completed the following Human Subjects Training Course:

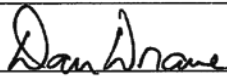
- CITI – Biomedical Research Investigator
- CITI – Social and Behavioral Research Investigator
- CITI – IRB Member

Allie J. McLain

5/18/15

If Student Researcher; Signature of Faculty Advisor

Date

| | |
|---|--|
| Approval by Department Chair of Researcher of Record <i>(Dean, if Chair is the Researcher or if Chair is otherwise unable to review.)</i> | |
| I have reviewed this research study. I believe the research is sound, that the study design and methods are adequate to achieve the study goals, and that there are appropriate resources (financial and otherwise) available to the researcher. I support the study, and hereby submit it for further review by the IRB. | |
|  _____ <i>Signature of Department Head or Dean</i> | <u>5-18-15</u> _____ <i>Date</i> |

Note: Do not use personal home addresses and phone numbers on Informed Consent, Assent, Parental Permission or Debriefing statements.

Appendix B Informed Consent Agreement

Winthrop University Informed Consent Agreement

Researcher: Stacey O'Neill

Researcher's Winthrop Position: Athletic Training Graduate Assissant

Title of Study: The Effects of the FIFA 11+ Warm Up Program in Collegiate Female Soccer Athletes

You are invited to take part in a research study. Before you decide to be a part of this study, you need to understand the risks and benefits. This consent form provides information about the research study. I will be available to answer your questions and provide further explanations. If you take part in this research study, you will be asked to sign this consent form. Your decision to take part in this study is voluntary. You are free to

choose whether or not you will take part in the study. If you should decide to participate, you may withdraw from the study at any time.

Purpose of the research study:

The purpose of this study is to obtain information in order to determine whether or not the FIFA 11+ program improves the skills of female soccer players, and is an appropriate soccer warm up program.

Procedures or methods to be used in the study:

This study will include two separate testing days. On these days the subjects will be asked to complete four exercsie test. Two of the test will test balance, one will test strength, and the other will test functional agility. The subjects will be asked to complete the FIFA 11+ warm up program 3 times per week for 8 weeks.

Number of questions in the survey/questionnaire and anticipated time to complete the survey/questionnaire: Subjects will complete four physiscal test (as stated above). It is antipated that the testing will take one hour to complete.

Possible Risks/Benefits Associated with Participating in Study:

There is a minor risk of injury that could be obtained when performing the exercises in the FIFA 11+ program. However, as long as the exercises are completed correctly this risk is unlikely to occur. Benefits from the study are the new techniques the subjects will learn that will help improve their skills as a soccer athletes.

Possible Costs/Compensation Associated with Participating in Study:

All testing will be completed at [REDACTED] The only cost associated with this study will include the travel to and from the testing site on testing days.

Right to withdraw from the study:

All participants have the right to withdraw from this study at any time, without penalty.

Privacy of records or other data collected in the study:

All subjects in this study will receive an ID number. This number and your name and information will be kept in a locked filing cabinet. All forms with information from your test will only contain your ID number on it. It will not include any personal information, and will be kept in a separate, locked cabinet.

Questions – contact information:

If you have any questions about this study, you may contact me at the following address:

Address: [REDACTED]

Work Phone: [REDACTED]

Email: [REDACTED]

You may also contact:

Deborah Broome, Compliance Officer
broomed@winthrop.edu

803-323-2398

Sponsored Programs and Research
Winthrop University
Rock Hill, SC 29733

Signatures:

By signing this consent agreement, you agree that you have read this informed consent agreement, you understand what is involved, and you agree to take part in this study. You will receive a copy of this consent form.

Signature of Participant

Date

Signature of Researcher

Date

Appendix C Demographic Questionnaire

Subject ID #: _____

Age: 18 19 20 21 22 23 24

Years of soccer experience: 1 2 3 4 5 6 7 8 9 10

Years of club soccer experience: 0 1 2 3 4 5 6 7 8 9 10

Years of colleague soccer experience: 1 2 3 4

Foot dominance: Right Left Both

Position (Circle all that apply): Forward Midfield Defense Goalie

Have you experienced any previous injuries (if yes, explain below): Yes No

| Injury Type | Amount of times this injury has occurred? |
|------------------------|---|
| Foot/Ankle (R / L) : | |
| Knee (R / L): | |
| Hip (R / L): | |
| Thigh (R / L): | |
| Head: | |

How long ago was the injury? _____

Where you withheld from soccer participation? _____ If yes, for how long? _____

Are you currently injured? (if yes, explain): Yes _____ No

| Injury Type | Amount of times this injury has occurred? |
|------------------------|---|
| Foot/Ankle (R / L) : | |
| Knee (R / L): | |
| Hip (R / L): | |
| Thigh (R / L): | |
| Head: | |

Appendix D

Instructor Scripts

Biodex Balance System

The following instructions were given to the participants:

- Instructor:
 - “Please step onto the plat form and center your right/left foot along the center line of the plat form.”
 - “Adjust your body position and foot until you are able to bring the cursor to the center of the screen.”
 - “You will follow the instruction provided on the screen and move your body, without lifting your foot up. You may shift your weight/position to keep the cursor in the center of the target on the screen.”
 - “Before each trial there will be a three second count down before data is collected. This countdown will occur before each trial.”
 - “You will complete three trials per leg.”
 - “There will be a ten second rest period between each trial.”
 - “Do you have any questions before we begin?”

Balance Error Scoring System

The following instructions were given to the participants:

1. Double Leg Stance – Firm Surface

- a. “Please stand with both legs and feet together, and place your hands on your hips. Be sure that your feet are together and touching.”
- b. “When I say go, close your eyes and hold this position the best you can. You will hold this stance for twenty seconds.”
- c. “If you are to move, sway or lose balance, please reposition yourself.”
- d. “I will be standing next to you in order to help you in the occurrence that you fall.”
- e. “When I say ‘stop’ open your eyes and relax.”

2. Single Leg Stance (non-dominant foot) – Firm Surface

- a. “Please stand on your non-dominant leg with your hands placed on your hips.”
- b. When I say go, close your eyes and hold this position the best you can. You will hold this stance for twenty seconds.”
- c. “If you are to move, sway or lose balance, please reposition yourself.”
- d. “I will be standing next to you in order to help you in the occurrence that you fall.”
- e. “When I say ‘stop’ open your eyes and relax.”

3. Tandem Stance (non-dominant foot in back) – Firm Surface

- a. “Please stand with your non-dominant foot behind your dominant foot, so that your non-dominant toes touch your dominant heel. Place your hands on your hips.”
- b. When I say go, close your eyes and hold this position the best you can. You will hold this stance for twenty seconds.”
- c. “If you are to move, sway or lose balance, please reposition yourself.”
- d. “I will be standing next to you in order to help you in the occurrence that you fall.”
- e. “When I say ‘stop’ open your eyes and relax.”

4. Double Leg Stance –Foam Surface

- a. “Please step onto the foam pad/surface. Stand with both legs, and feet together, and place your hands on your hips. Be sure that your feet are together and touching.”
- b. “When I say go, close your eyes and hold this position the best you can. You will hold this stance for twenty seconds.”
- c. “If you are to move, sway or lose balance, please reposition yourself.”
- d. “I will be standing next to you in order to help you in the occurrence that you fall.”
- e. “When I say ‘stop’ open your eyes and relax.”

5. Single Leg Stance (non-dominant foot) – Foam Surface

- a. “Please step onto the foam pad/surface. You will stand on your non-dominant leg with your hands placed on your hips. “

- b. When I say go close your eyes and hold this position the best you can.
You will hold this stance for twenty seconds.”
 - c. “If you are to move, sway or lose balance, please reposition yourself.”
 - d. “I will be standing next to you in order to help you in the occurrence that you fall.”
 - e. “When I say ‘stop’ open your eyes and relax.”
6. Tandem Stance (non-dominant foot in back) – Foam Surface
- a. “Please step onto the foam pad/surface. Stand with your non-dominant foot behind your dominant foot, so that your non-dominant toes touch your dominant heel. Place your hands on your hips.”
 - b. When I say go close your eyes and hold this position the best you can.
You will hold this stance for twenty seconds.”
 - c. “If you are to move, sway or lose balance, please reposition yourself.”
 - d. “I will be standing next to you in order to help you in the occurrence that you sway or fall.”
 - e. “When I say ‘stop’ open your eyes and relax.”

5-Dot Agility Test

The following instructions were given to the participants:

1. Up & back

- a. “Please start with your feet on dot A and B and then rapidly jump with both feet on C”
- b. “You will then jump so that one foot lands on D and the other one on E”
- c. “You will then jump back to the starting point.”
- d. “You will repeat this pattern six total times at the highest speed you feel comfortable doing.”

2. Right Foot

- a. “Please place your feet on dot A and B.”
- b. You will jump onto C with your right foot and then continue with your right foot to jump to D, E, C, A, B, in that order.”
- c. “You will repeat this pattern six total times, at the highest speed you feel comfortable doing.”

3. Left Foot

- a. With the previous exercise the subject will end with their right foot on dot B.
- b. “You will next jump with your left foot onto dot C. Continue with your left foot and jump to D, E, C, A, B.”
- c. “You will repeat this pattern six total times, at the highest speed you feel comfortable doing.”

4. Both Feet

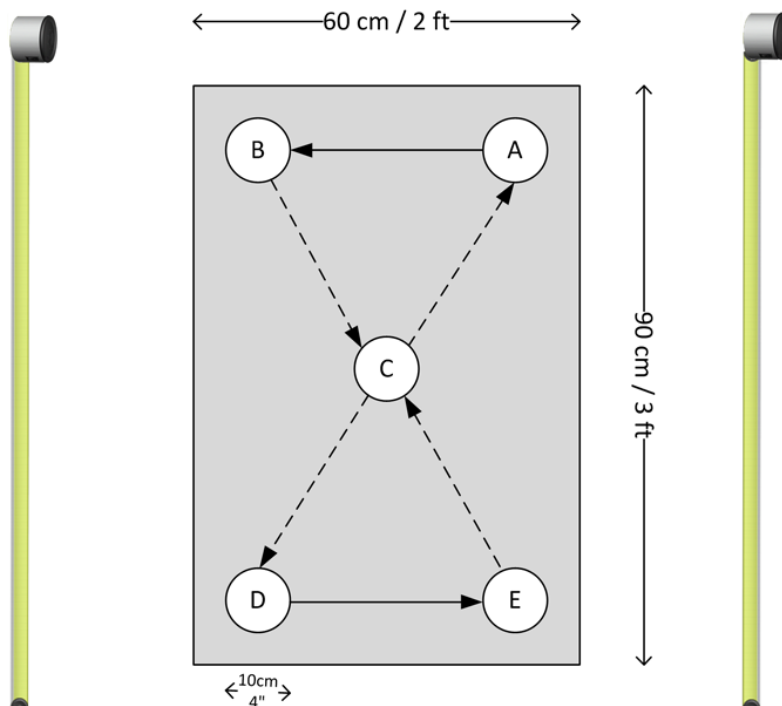
- a. With the previous exercise the subject will end with their left foot on B.
- b. “You will jump with both feet onto dot C.”
- c. “Then you will jump with both feet onto D, E, C, A, B.”
- d. “Continue to jump back to the starting point.”
- e. “You will repeat this pattern six total times, at the highest speed you feel comfortable doing.”

5. Turn Around

- a. With the previous exercise the subject will end with both feet on dot B.
- b. “Next you will jump with both feet onto dot C.”
- c. “Then jump so that one foot lands on D and other on E, just like in exercise #1.”
- d. “You will then turn around clockwise 180° (your feet will still be on E and E), and jump onto dot C with both feet. Then jump and have one foot land onto dot A and the other onto dot B.
- e. “Turn again around to the left (counter-clockwise) 180° and start again.”
- f. “You will repeat this pattern six total times, at the highest speed you feel comfortable doing.”

“All stages of this test will be performed back-to-back, without stopping. A test/trial run of the exercises will be complete prior to data collection. I will continue to give instruction throughout the data collection trial.”

Example of 5-Dot Agility Test step up:



Biodex Dynamometer System 3

The following instructions were given to the participants:

1. 90 Degrees/second – for dominant and non-dominant legs.
 - a. “For this test you will kick/extend your leg as straight as you can, and then bend/flex her knee as much as you can.
 - b. “For this test, you will be moving against a higher resistance. Kick and pull your leg as fast/hard as you can.”
 - c. “Make sure you are kicking out and extending your knee, as much as you can. You want to aim for my hand.” (Research advisor will place hand as a target).
 - d. “Make sure you are pulling your leg and flexing it all the way back into the chair.”
 - e. “You will complete a practice session for this speed before we begin. You will not begin the test until you are ready.”
 - f. “I will encourage you to ‘kick and pull’ throughout the process of the testing.”
 - g. “Do you have any question before we begin?”

2. 180 Degrees/second – for dominant and non-dominant legs.
 - a. “For this test you will kick/extend your leg as straight as you can, and then bend/flex her knee as much as you can, just like the trail before this.

- b. “However, you will be moving against a little less of resistance. You will be able to kick and pull your knee at a quicker speed. Please kick and pull your leg as fast/hard as you can.”
 - c. “Make sure you are kicking out and extending your knee, as much as you can. You want to aim for my hand.” (Instructor will place hand as a target).
 - d. “Make sure you are pulling your leg and flexing it all the way into the chair.”
 - e. “You will complete a practice session for this speed before we begin. You will not begin the test until you are ready.”
 - f. “I will encourage you to ‘kick and pull’ throughout the process of the testing.”
 - g. “Do you have any question before we begin?”
3. 300 Degrees/second – for dominant and non-dominant legs.
- a. “For this test you will kick/extend your leg as straight as you can, and then bend/flex her knee as much as you can, just like the trail before this.
 - b. “However, you will be moving against very little resistance. You will be able to kick and pull your knee at a quicker speed than before. Please kick and pull your leg as fast/hard as you can, while still going through the entire motion.”

- c. “Make sure you are kicking out and extending your knee, as much as you can. You want to aim for my hand.” (Instructor will place hand as a target).
- d. “Make sure you are pulling your leg and flexing it all the way into the chair.”
- e. “You will complete a practice session for this speed before we begin. You will not begin the test until you are ready.”
- f. “I will encourage you to ‘kick and pull’ throughout the process of the testing.”
- g. “Do you have any question before we begin?”

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