The Effects of a 90-Minute Soccer Match on Anaerobic Capacity

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In

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Abstract

Purpose: Soccer is the most popular sport in the world. Players have different skills for their positions; they must be able to maintain their physical performance at satisfactory levels to compete at elite levels. Although a large amount of data has been published regarding physical characteristics of soccer players, the literature sheds little light on the physiological demands and performance decrements that occur with participation in a soccer match. To address this gap, this study investigated how fatigue development affects the aerobic and anaerobic performance variables before and after a 90-minute soccer match.

Procedure: Fifteen experienced male collegiate and elite club-level soccer players were recruited from Sonoma State University, Santa Rosa Junior College, and Sonoma County Sol, (mean ± SD) age 23.0 ± 2.56 years, height 175.7 ± 4.75 (cm), weight 71.8 ± 6.51 (kg), BMI of 23.3 ± 1.82 (cm/kg). The study tested physiological stress before and after a 90-min soccer match, in anaerobic capacity using a vertical jump test, and the 50-meter sprint test; as well as agility using the t-test. Following performance testing, results were evaluated with repeated measures of ANOVA, and PRE and POST dependent variables were compared to see if there were any significant differences among trials.

Findings: The results indicated that there were significant differences between PRE and POST vertical jump test ($P<0.05$). Performance of the t-test showed significant differences between PRE and POST ($P<0.05$). There were no significant differences between PRE and POST 50-meter sprint tests ($P<0.05$).

Conclusions: Results showed an improvement in the anaerobic performance after a full 90-minute soccer match. The test results assist coaches in evaluating the physiological status of soccer players in order to provide the most effective training methods, diet and tactics to enhance performance.

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List of Abbreviations

VO_2max:	Maximal Oxygen Uptake
ATP:	Adenosine Triphosphate
PCr:	Phosphocreatine
ATP-PC:	Adenosine Triphosphate Phosphocreatine
Acetyl CoA:	Acetyl coenzyme A

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Chapter I: Introduction

Soccer is one of the most metabolically demanding, and popular sports in the world. It is a complex team sport that involves numerous players participating in a game at the same time; on fields that vary in size depending on the age of the participants. The amount of distance covered during a game corresponds with the position that an individual is playing, as well as the formation played by the team, with attackers and midfield players covering more distance than defenders (Robineau et al., 2012).

Soccer competition is characterized by intermittent physical activities in which sequences of actions requiring a variety of skills of different intensities are strung together (Robineau et. al. 2012), where players need technical, tactical, and physical abilities to succeed (Helgerud et. al. 2001). These values vary according to the player, but it has been estimated that approximately 80 to 90% of performance is spent in low to moderate intensity activity; whereas the remaining 10 – 20% are high intensity activities (Bloomfield et al., 2007). Previous studies have determined that the metabolic demand placed on a soccer player is approximately 70% anaerobic and 30% aerobic (Bangsbo et al., 2006; Osgnach et al., 2010). Although soccer is mainly anaerobic, a high level of aerobic fitness is important in helping sustain a high work rate, and assist in rapid recovery between short, intermittent bouts of high intensity efforts during the game (Nassis, G.P. et al 2010).

Although soccer is a highly studied sport in research settings, coaches, trainers, and athletes continually search for effective methods to identify and develop physical characteristics that may contribute to sport performance. Assessing athletic talent is achieved through physical ability testing (Pauole et al., 2000). Among these tests, the assessment of repeated-sprint, muscular power, and aerobic fitness are popular among coaches and applied sport scientists (Rampinini et al., 2006). Additionally, a player's position on a soccer field often imposes different energy demands throughout a soccer game.

In several studies involving fatigue induced from a 90-minute soccer game, subjects/players are not identified by there position (Robineau et al., 2012; Little et al., 2005; Nassis et al., 2010; Zemlova et al., 2009). Studies that do not acknowledge the different positions on a soccer field are incomplete in their findings. Researchers have found that the different positions require different ranges of actions, according to where the player is located on the field; midfielders have been found to cover the most ground; defenders perform the most lateral movement; and forwards execute the most and longest sprints (Bloomfield et al., 2007; Dellal et al., 2012; Di Salvo et al., 2007). If we can recognize the specificity to each soccer position on a field, we can better understand the metabolic demand placed on each of these positions.

The purpose of this study was to assess the physiological demands placed on college level soccer players before and after a 90-minute game; and to analyze the impact that a game has on their pre-match physiological assessments, especially anaerobic capacity.

Hypothesis

1. We hypothesized that the fatigue induced by a 90-minute game would not affect the height of the subject's vertical jump, but would show a small decrease in the time it takes the players to complete a 50m sprint. Though all of the positions engage in jumping movements during a match, this may not decrease their vertical jumping performance due to quick restoration of ATP-PC system (Robineau, 2012; Zemkova & Hamar, 2009).

Assumptions

We assumed subjects would employ full effort in all preliminary testing, pre-testing, and post-testing protocols. They would perform to the best of their abilities during the full 90-minute soccer match regardless of health and psychological state of mind.

Limitations

Limitations to the study would include variance of subjects' fasting and hydration conditions before the match, although we have asked them to replicate their meal plan and quantity of drinks from the first visit on the second day of data collection. We asked them to refrain for 24 hours from using drugs of any sort, as well as from heavy exercise.

The change in day-to-day weather conditions might influence the athletic performance, but our data was collected during summer time in Northern California, at the same time of the day and with temperature differences that were not obvious. Some players were unable to finish the test protocol due to injuries or health. We used only highly trained college and elite club level male subjects in order to eliminate confounding variables that might arise with different experience levels.

Definition of Terms

VO2max: The traditional standard measurement for cardiorespiratory fitness is V02max, or the maximal volume of oxygen per kilogram body weight per minute. Maximal oxygen consumption (V02max), is the maximal oxygen that an individual can use during intense exercise. Once this measurement is determined, a common method to establish exercise intensity is to have clients exercise at a percentage of their V02max (Clark et al., 2012 pg 194).

T-test: The test is described as a measure of a 4-directional agility and body control that evaluates the ability to change directions rapidly while maintaining balance without loss of speed (Semenick, 1990). The T-test is often used in experiments, because it is relatively simple to administer, and requires minimal equipment and preparation (Pauole et al., 2000).

Vertical jump test: The vertical jump test, also referred to as the countermovement maximal jump test, involves subjects jumping to a peak height. This test requires explosive power from the lower limps, and to measure this power is its function (Henderick, A. et al., 1996).

Sprint test: Sprint tests of this distance are commonly used to measure an individual's leg speed (Pauole et al., 2000).

ATP-PC: The ATP-PC system provides energy for primarily high-intensity, short duration bouts of exercise or activity (Clark, 2012). This energy comes from the muscular stores of ATP and PCr; where the stored ATP is immediately broken down to liberate energy, and the PCr is broken down to resynthesize this ATP. Once these energy stores have been depleted, the energy must be produced by another system. With this depletion, the intensity of the exercise has to fall; but the system recovers quickly, and ATP and PCr are will be replenished after 4-5 minutes (Mcardle et al., 2010).

Metabolism: All of the chemical reactions that occur in the body to maintain itself. Metabolism is the process in which nutrients are acquired, transported, used, and disposed of by the body (Clark et al., 2012).

Anaerobic Glycolysis: Anaerobic glycolysis, also known as anaerobic metabolism, is a component of the lactic acid system, and involves the breakdown of glycogen that is stored in the muscles without the presence of oxygen. This process is utilized after the depletion of the ATP-PC system, where ATP must by resynthesized to continue intense activity (Mcardle et al., 2010)). This process allows for quick ATP resynthesis, but produces lactic acid as a by-product. Lactic acid accumulates in working muscles and causes intense pain and lack of coordination, which leads to a reduction in performance. The system is used in moderate to high-intensity activity over a period of 1-2 minutes, or sustained bursts of moderate to high activity with rest periods in between.

Aerobic Glycolysis: Also known as aerobic metabolism, the aerobic process is similar to anaerobic, except that the process has the presence of oxygen. The presence of oxygen determines the end product of pyruvic acid; which is converted into an important molecule known as acetyl coenzyme A (acetyl CoA). Acetyl CoA contributes substrates for the second process of oxidative production of ATP, called the Krebs cycle. The complete oxidation of acetyl CoA produces two units of ATP and the by-products carbon dioxide and hydrogen. Hydrogen ions released during glycolysis and during the Krebs cycle combine with other enzymes and in the third process of oxidation, ultimately provide energy for the oxidative phosphorylation of ADP to form ATP (Clark et al., 2012).

Chapter II: Review of Literature

Tests to Assess Physiological Demands

Soccer is a popular sport worldwide; however, studies to improve soccer performance have often focused on technique and tactics at the expense of physical resources such as endurance, strength, and speed (Helgerud et al., 2001). Before a test to measure the player's abilities could be administered, the most valid tests that could be used had to be determined, but tests that also shared similarities with a soccer match. The physiological attributes that will be tested are; aerobic endurance, muscular endurance, muscular power, agility, and leg speed.

Agility, as well as leg power and leg speed are believed to be important physical components necessary for successful performance in many sports and recreational activities, including soccer (Pauole et al., 2000). Agility does not have a global definition, but it is often recognized as the ability to change direction and start and stop quickly (Little et al., 2005). In a study involving 86 physical education students at a university participating in a variety of team sports, the T-test was determined to be a valid test for assessing individual's agility (Haj Sassi et al., 2009). The T-test is described as a measure of 4-directional agility and body control that evaluates the ability to change directions rapidly while maintaining balance without loss of speed (Pauole et al., 2000).

Muscular power is defined as the rate of work or the force multiplied by the velocity of movement (Kawamori et al., 2004). Muscular power is an important prerequisite for sprinting, and is therefore also commonly assessed in soccer players performance. In addition to sprinting, muscular power is also required for soccer players to perform activities such as striding, turning, and jumping (Rampinini et al., 2007). The vertical jump test consists of a countermovement vertical jump to a peak height, and requires explosive leg power to be accomplished (Pauole et al., 2000), which will allow us to assess muscular power.

Aerobic fitness is a necessity for individuals striving to compete at a high level of soccer; several studies have shown that a good level of aerobic fitness is required to meet the physiological demands of soccer (Bloomfield et al., 2007; Raminini et al., 2007; Helgerud et al., 2000; Meckel et al., 2009). Aerobic endurance becomes more important, and must be developed if an individual is striving to reach a high performance level in soccer (Tonnessen et al., 2011). VO2max tests have been accepted as the most widely used criterion in measuring aerobic fitness (Aziz et al., 2007); and have been shown to be positively correlated with the distance covered during a game (Meckel et al., 2009).

Physical Demands by Position

Soccer is a complex game in which each position has a role he or she is supposed to accomplish to contribute to a match. These roles can significantly change depending on which position the individual is placed in; at the international level, aerobic is the most required quality among midfield players, whereas strength and running speed are of great importance for attackers (Tonnessen et al., 2011). Researchers have been able to determine some of the physical attributes necessary for the different field positions through match observation, by analyzing the movement of each position. Through this observation it has been found that central midfielders spend the smallest amount of time walking and jogging, but covered the largest distance in low and moderate intensity running (Di Salvo et al., 2007). Though midfielders were found to cover the most distance during a 90-minute match, forwards were found to perform the most maximal sprints and for longer durations, followed by midfielders and defenders (Bloomfield et al., 2007).

Running durations and intensities were not the only in game movements analyzed by researchers. Soccer consists of more than just running, it also involves numerous actions including jumping, tackling, passing, shooting, heading; with different individuals having to perform these actions more or less depending on position (Bloomfield et al., 2007). Defenders have been found to perform the most tackles during a match, which also requires them to exert energy getting themselves up from the ground; and strikers were found to perform the most physical contact at high intensity, requiring the need to be physically strong (Bloomfield et al., 2007). Modern technologies have allowed researchers the opportunity to breakdown and analyze in detail a soccer match; which in turn has provided information on the demands of a game on players according to their position.

Implications for Coaches and Trainers

There have been numerous studies conducted with the purpose of verifying differences among playing position, and to quantify the demands placed on these players in each of the individual positions during the match (Bloomfield et al., 2007; Di Salvo et al., 2007). Coaches and trainers are constantly looking for methods to analyze and identify attributes that contribute to soccer performance; and there are a variety of tests available for them to test these attributes (Rampinini et al., 2007). Understanding the physiological load imposed on top-level soccer players according to their positional role during competitive matches is necessary to develop a sport specific protocol (Di Salvo et al., 2007). When conducting any of these assessments coaches and trainers should attempt to select an appropriate field tests for a sport or other physical activity; which should center on the specific demands of the sport or activity to be analyzed (Pauloe et al., 2000).

Field tests and assessments help coaches and trainers to identify attributes of a soccer game that are necessary to perform, and they can use this information to train their players, and improve their performance. Just as field tests should analyze specific movements that are performed by soccer players during a match, so should training plans be based on specific demands required to perform in a game. Training plans from coaches should not be restricted to a general plan for all players on the team; training prescriptions in soccer should be based on the specific requirements of the playing position thereby ensuring players are better able to fulfill their tactical responsibilities during the game (Di Salvo et al., 2007).

CHAPTER III: METHODOLOGY

Experimental Approach to the Problem:

This study was aimed at determining if soccer players on the field require diverse physiological demands, using collegiate and club men’s soccer players as subjects. The study also sought to establish the physiological characteristics a player must attain to successfully perform anaerobic and aerobic engagements within a soccer match.

Protocols

Day 1: Fifteen experienced male soccer players (n=15) were recruited for this study. Before the first day of testing, we introduced the main goal and intention of the study. The subjects were given informed consent forms; they were notified to sign and turn in the forms to participate. Then, participants were familiarized with the 3 tests that included the t-test, vertical jump test, and 50-meter sprint.

Day 2: On the second day, the participants performed the vertical jump test and 50-meter sprint PRE and POST soccer match. The vertical jump tests consisted of 4 trials with 1 minute of rest between each trial. Following the vertical jump tests the participants had 15 minutes of rest before performing the 50-meter sprint test. The participants performed two 50-meter sprint tests with 3 minutes of rest between each sprint.

Vertical jump performance is a simple measure of lower limb muscular power, and has been used to evaluate training-induced changes in soccer players (Rampinini et al., 2007). The countermovement vertical jump test, which was used in this experiment, involves the subject jumping to their peak height and requires explosive leg power (Hendrick et al., 1996). The standing vertical reach was determined with the dominant arm of the subject. A Vertec height-measuring device was used to measure the countermovement vertical jumps (Pauole et al., 2000). During each trial subjects were allowed to swing their arms freely but were not allowed any preparatory step before jumping (Haj Sassi et al., 2009).

Sprint tests of this distance are commonly used to measure an individual's leg speed (Pauole et al., 2000). For this test subjects began with one foot placed on a touch-sensitive timing pad. At the end of the 50m there were two sensors mounted on tripods on each side of the finish line. Time started the moment the subject released their weight from the pad. Timing stopped when the subject ran through the two sensors at the end of the 50m.

Day 3: On the second day, the participants performed the t-test PRE and POST soccer match. Each participant performed 3 trials for the t-test, with 1 minute of rest between each test.

The T-test was administered using the protocol outlined by Semenick (1990).. For this test subjects began with both feet behind the starting point A. At their own discretion, each subject sprinted forward 9.14 m (10 yd) to point B; they then shuffled to the left 4.57 m (5 yd) to point C. Subjects then shuffled to the right 9.14 m to point D; and then shuffled to the left 4.57 m back to point B. The subjects then ran backward, passing the finish line at point A (Pauole et al., 2000).

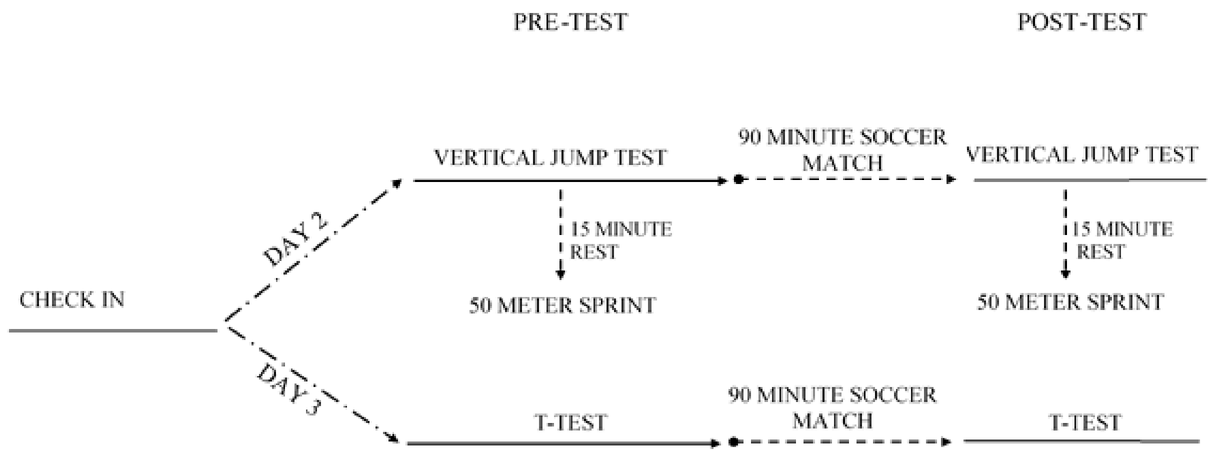

Figure 1. Represents the outline of the study design

Procedures

We conducted the experimental program during a period of 5 days where the subjects were instructed to have no exercise within 24 hours of the testing protocol days. They visited the laboratory, soccer field, and track for measuring the anthropometric and performance variables at Sonoma State University. There was a warm-up of 10-15 minutes, consisting of stretching and jogging, before the full 90-minute soccer match. The order of test protocol and rest time in between tests was consistent for all subjects. Data was assessed and gathered for baseline testing and for post-testing after a full 90-minute soccer match.

Statistical Analyses

All data was analyzed using the statistical package SPSS 22 (SPSS, Inc., Chicago, IL, USA). Subject characteristics are presented as descriptive statistics for age, height, body mass, body composition, t-test, vertical jump test, and 50-meter sprint. Measures of central tendency and variations were calculated for all variables, and outliers (2 SD) were identified and analyzed for confounding factors. The effects of the soccer match on agility (t-test), muscular power (vertical jump test), and 50-meter sprint performance Pre- and Post-testing variables were measured with a 2-way repeated-measure analysis of variance with factors group and time (PRE and POST game). In the event of a significant F score, paired t-test was used post hoc to determine pair-wise differences. A t-test was used to see the effect of treatments within groups with the accepted level of statistical significance set at $p < 0.05$. All results are presented as mean ± SD.

Chapter IV: Results

On the morning of check-in, testing took place on the Sonoma State soccer practice fields. Informed consent was acquired prior to any testing. Participants were then screened for their body composition, height, weight and age. The participants (n=15 male athletes) with an average age of 23.0 ± 2.56 years had an average baseline body mass of 71.8 ± 6.51 kg, average height of 175.7 ± 4.75 cm, and an average BMI of 23.3 ± 1.82 cm/kg. The participants were soccer players from several soccer teams from the Sonoma area; Sonoma State University (Division II NCAA), Santa Rosa Junior College (NJCAA) and Sonoma County Sol (NPSL). The participants had roughly 7-10 years of soccer experience, and were regularly involved in a fitness routine.

SUBJECT	**AGE (yr)**	**HEIGHT (cm)**	**WEIGHT (kg)**	**BMI (kg/m^2)**
Averages (± SD)	23.0 ± 2.56	175.7 ± 4.75	71.8 ± 6.51	23.2 ± 1.82

Table 1. Represents subjects' anthropometric characteristics, represented as ± SD for height, weight, age, and BMI.

Our results demonstrated that a 90 min soccer match had no influence on the 50m sprint test and any anaerobic variables testing among the positions, however significantly improved ($P < 0.05$) vertical jumping and T-test values Pre to Post soccer match were found.

Vertical Jumping Test

The vertical jumping test measured the muscular power of the subjects. Subjects performed 4 vertical jumps with 1 minute of rest between each attempt. The average height for the vertical jump test between the subjects was 54.44cm ± 7.11 and 55.03cm ± 7.24, pre and post match respectively (*See Figure 1*). We noticed a statistically significant ($P<0.05$) increase in the participant's vertical jump after a 90-minute soccer match.

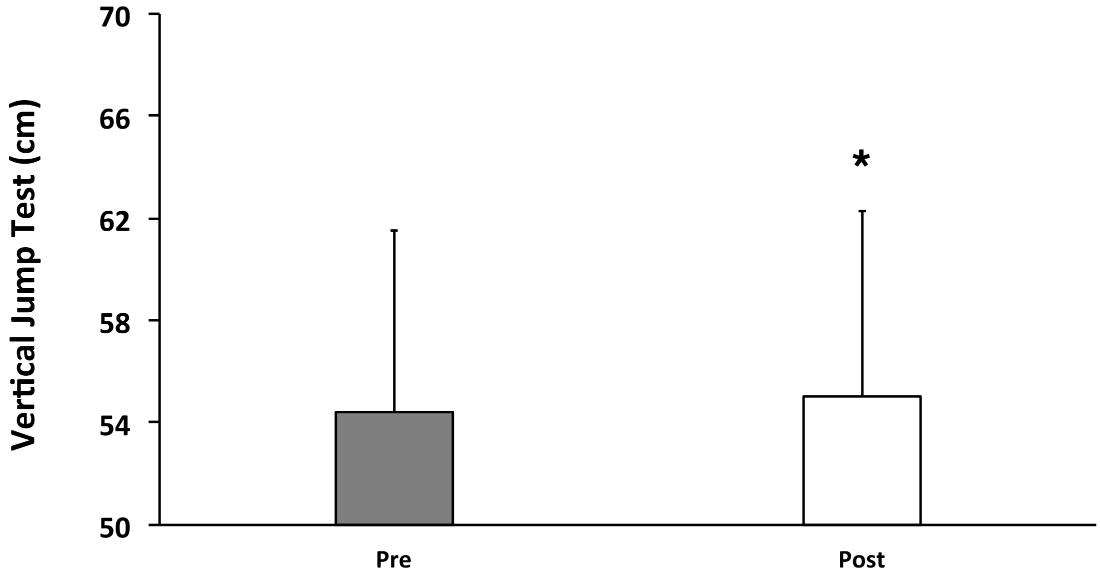

Figure 2. Represents the average vertical jumping height in centimeters of the Pre and Post 90-minute soccer match values. *, Significantly different (P<0.05) from Pre.

T-Test

Agility was measured using the T-test. Subjects completed 3 attempts with 3 minutes of rest between each attempt. The average time for the t-test between the subjects was 10.55sec ± .42 and 10.37sec ± .49, pre and post match respectively, (*See Figure 2*). There was a statistically significant (P<0.05) decrease in the participant's T-test results after a 90-minute soccer match.

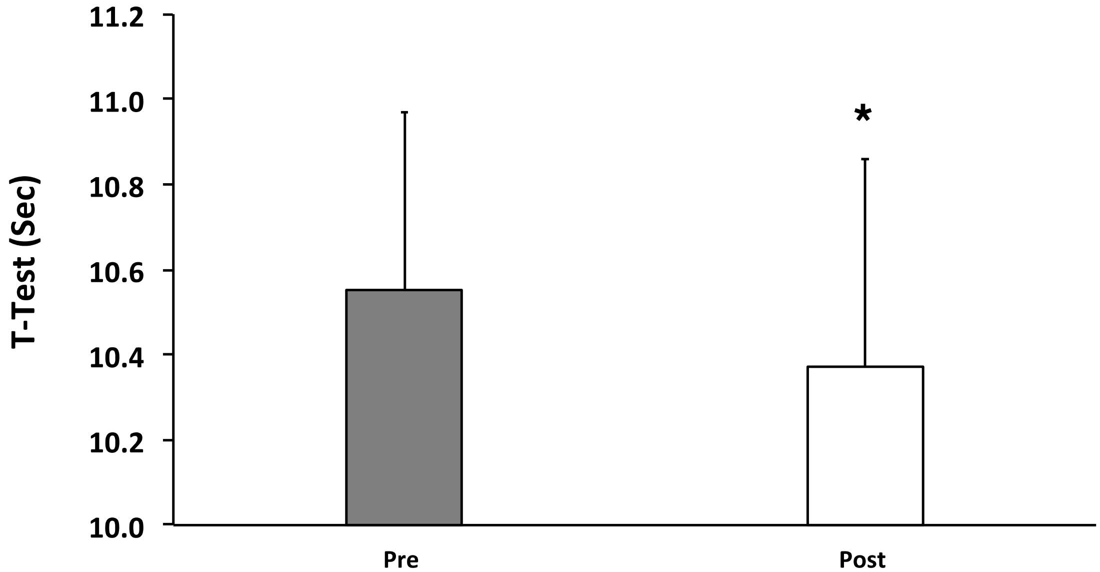

Figure 3. Represents the average time in seconds of the Pre and Post 90-minute soccer match values. *, Significantly different (P<0.05) from Pre.

50-Meter Sprint

The speed of the subjects was determined by their 50-meter sprint time. Subjects completed 2 attempts with 3 minutes of rest between each attempt. The average time for the 50-meter sprint between the subjects was 7.38sec ± .34 and 7.37sec ± .33, pre and post match respectively, (*See Figure 3*). We did not observe significant differences in 50-meter sprint performance between pre and post match trials.

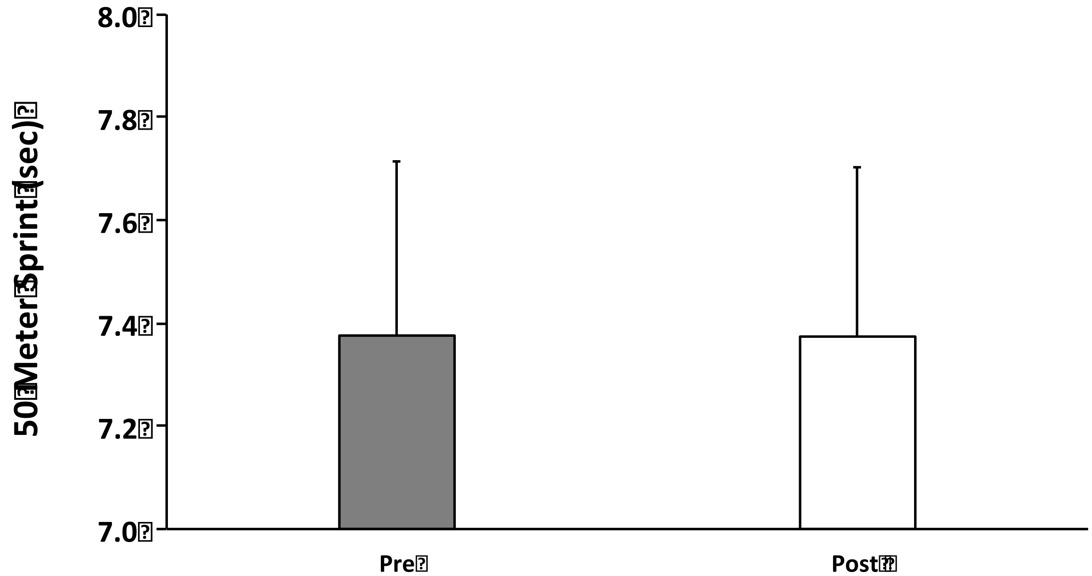

Figure 4. Represents the average time in seconds of the Pre and Post 90-minute soccer match values.

	Pre-Match	Post-Match	Absolute Change (s)	% Change
Vertical Jumping	54.44cm ± 7.11	55.03cm ± 7.24	0.59	1.1
T-Test	10.55sec ± .42	10.37sec ± .49	-0.18	-1.7
50-meter Sprint	7.38sec ± .34	7.37sec ± .33	-0.01	-0.14

Table 2. Represents the participants average vertical jumping, t-test, and 50-meter sprint test before (pre) and after (post) 90-minute soccer match. The table also shows the participants' absolute change, and % change for each of the three tests.

Chapter V: Discussion

The purpose of this study was to assess the physiological demands placed on club level soccer players from a 90-minute match. In order to accomplish this, the physiological demands were assessed through the subjects completing three game related field tests before and after the soccer match. These tests mainly focused on anaerobic capacity of the soccer athletes and essential to compete at a high level; muscular power, agility, and speed.

Vertical Jump Test

Muscular power is essential for sprinting and jumping, and is therefore commonly assessed by soccer coaches and sports scientists (Rampinini et al., 2006). This study used the vertical jump test to measure the muscular power of our subjects. The vertical jump test requires explosive power from the lower limbs, and its function is to measure this power (Henderick er al., 1996). The procedure used in this test was similar to that of a study involving 304 college-aged men and women selected from varying levels of sport participation, where the subjects were allowed to swing their arms freely, but were not allowed any preparatory step before jumping (Pauole et al., 2000).

The average height for the vertical jump test between the subjects was 54.44cm ± 7.11 and 55.03cm ± 7.24, pre and post match respectively. We noticed a statistically significant ($P<0.05$) increase in the participant's vertical jump after a 90-minute soccer match. This contradicts our hypothesis that the fatigue induced from a 90-minute soccer match will not have an effect on the height of the subject's vertical jump. This result was not anticipated which might be due to the quick recovery of the ATP-PC system, which takes 4-5 minutes following intense work (Mcardle et al., 2010). The ATP-PC system provides energy for primarily high-intensity, short duration bouts of exercise or activity (Clarke, 2012), and is used in short explosive movements such as the vertical jump test. Another reason for the improvement in performance of the vertical jump test is the amount of rest that was given to the subjects between the end of the match, and the start of the post-match testing. Subjects were given 15 minutes of rest, which allowed recovery of the ATP-PC system.

Several studies have found that the fatigue induced from a 90-minute soccer match has little effect on the performance of the vertical jump test. After analyzing the neuromuscular fatigue of eight amateur soccer players induced by a 90-minute soccer game modeling Robineau et al. (2012) found that the performance of their vertical jump test was unaffected. Zemkova et al. (2009) also found no change in the performance of the vertical jump. In the study they evaluated the effect of soccer match induced fatigue on the neuromuscular performance of 10 elite soccer players prior to, during the break between the first and second half, and after the match.

T-Test

Agility is another attribute deemed to be an important physical component necessary for successful performance in many recreational activities and sports, including soccer (Pauole et al., 200; Little et al., 2005). Agility is often recognized as the ability to change direction, and start and stop quickly (Little et al., 2005). To measure the agility of the participants we used the T-Test protocol outlined by Semenick; the test is described as a measure of 4-directional agility and body control, that evaluates the ability to change directions rapidly while maintaining balance, without the loss of speed (Semenick, 1990).

The average time for the t-test between the subjects was 10.55sec ± .42 and 10.37sec ± .49, pre and post match respectively. We noticed a statistically significant ($P<0.05$) increase in the participant's vertical jump after a 90-minute soccer match. These results contradict our hypothesis that the fatigue induced from a 90-minute soccer match will have a negative effect on the time it takes the subjects to complete the T-Test. Similar to the vertical jump test, these results could be due to the quick recovery of the ATP-PC system.

It has been estimated that approximately 80-90% of soccer performance is spent in low to moderate intensity activity whereas the remaining 10-20% are high intensity activities (Bloomfield et al., 2007). The lack of activity spent at high intensity may have also influence the performance of the subjects post match testing.

The positions on a soccer field can be separated into three general classifications; defender, midfielder, and forward. The positional role of each player has an influence on the total energy expenditure in a match, suggesting different physical, physiological, and bioenergetics requirements are experienced by players of different positions (Bloomfield et al., 2007). The position of the subjects may have had an effect on their post match test performance. In a 2002 study involving 18 top class and 24 lower level professional soccer player; movement of each player was analyzed through VHS-format cameras, and broken down into four locomotor categories; standing, walking, low-intensity running, and high intensity running (Mohr et al., 2003). They found that attackers covered more distance at high intensity than midfielders. If the subjects in our study played midfield during the match, than they covered less distance at high intensity, and this could affect their post match test performance.

50-Meter Sprint

The last physical attribute that was tested in this study was the participant's maximum speed. We tested their speed using a 50-meter sprint test. The average time for the 50-meter sprint between the subjects was 7.38sec ± .34 and 7.37sec ± .33, pre and post match respectively. We did not observe significant differences in 50-meter sprint performance between pre and post match trials. This did not comply with our hypothesis that the fatigue induced from a 90-minute soccer match will have a negative effect on the time it takes the subjects to complete the 50-meter sprint. We thought that the amount of sprints performed by each subject would have an effect on their post match tests, but there was not a significant difference when comparing those results to their baseline tests. Similar to the vertical jump test and t-test, these results could be due to the quick recovery of the ATP-PC system.

Conclusion

The purpose of this study was to identify the effect of a 90-minute match on attributes that we determined were essential for soccer competition. Our results demonstrate that the T-Test and vertical jump test improved significantly following a 90-minute match. Although, the 50-meter sprint did not show any changes following a 90-minute match. The immediate energy source of anaerobic capacity (ATP-PC system) did not suffer following a soccer match; this may be due to 1) rapid recovery of that energy system which might take up to 5 minutes, 2) loss of body weight (we have not measured) which might increase relative strength, 3) through post-activation potentiation phenomena, 4) increased muscle temperature which might lead into greater ATPase activity.

Although we did not find significantly reduced anaerobic capacity, we recommend coaches and strength and conditioning specialists implement speed and agility work in order to meet physiological and metabolic demand of a soccer match.

Since we could not achieve statistical power due to limited subject in this study, for future research, we recommend study with respect to player position in the field. Then, the coaches and strength and conditioning specialist will be able to create position specific workouts for their athletes.

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Appendix A:

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SONOMA STATE UNIVERSITY—INSTITUTIONAL REVIEW BOARD FOR THE RIGHTS OF HUMAN SUBJECTS

Application for Approval of Research Involving Human Subjects

This application is designed to fulfill the responsibilities of Sonoma State University relative to the Code of Federal Regulations, Title 45, Part 46, regarding research involving human subjects. Failure to comply with the policies and procedures referenced in this application (1) may cause individuals to incur personal liability for negligence and harm; (2) may cause the University to lose federal funding, prevent individuals from applying for or receiving federal research funds, and prevent the University from engaging in research; and (3) will be viewed by SSU as a violation of university policies and procedures and will result in appropriate administrative action.

All research involving the use of human subjects conducted by SSU faculty, staff, or students —or sponsored in part or whole by SSU— must be reviewed and approved by the University's Institutional Review Board (IRB) for the Rights of Human Subjects prior to the start of the project and then must be conducted in full compliance with University policies and procedures. **It is the responsibility of the principal investigator to refer to the IRB any project involving human subjects, even if the subjects are not considered to be "at risk."** This includes research conducted in conjunction with classroom assignments that will be published or shared, as well as student dissertation or thesis. It also includes all interviews, questionnaires, surveys, observations, educational tests, and secondary analyses of previously collected data that will be incorporated into published research or other public presentation. Such projects may be undertaken only after appropriate approval and may be continued only so long as that approval remains in effect. Changes in a project, or continuation of the project following adverse or untoward occurrences during the project, are also subject to review and approval.

Research intended solely for classroom use (with no possibility of further disclosure or publication) and conference/workshop evaluation surveys do **not** require IRB review.

Submit applications to: Sonoma State University, Institutional Review Board – Schulz 1105, 1801 East Cotati Ave., Rohnert Park, CA 94928

If you have any questions, contact the Office of Research and Sponsored Programs at 664-2448 or email *irb@sonoma.edu*

NOTE: *Your complete application is* ***due one month prior*** *to the start of your research. It should include:*

- *Pages 1-3 of this application plus additional pages for the Protocol Requirements (page 3) as needed.*
- *A copy of your written informed consent form OR a request for waiver of written informed consent with a copy of the oral text you intend to use to inform your subjects of the points listed on the Checklist of Informed Consent (see http://www.sonoma.edu/aa/orsp/human_subjects.shtml for a sample consent form and checklist).*

This form is designed to be completed on a computer using Microsoft Word. Complete all applicable gray form fields and check boxes. See http://www.sonoma.edu/aa/orsp/human_subjects.shtml for a version suitable for completion by hand or typewriter

Your signature below certifies that:

- You have read this 6-page packet and understand your responsibilities and liabilities as a principal investigator.
- You have reviewed the University's policies and procedures on research involving human subjects and will ensure your research is conducted in full compliance. Copies of the policies and procedures are available from the Office of Research and Sponsored Programs (ORSP) in Schulz 1105. The information is also posted on the ORSP website at http://www.sonoma.edu/aa/orsp/ .
- You have completed Module 2 (Investigator Responsibilities & Informed Consent) of the Human Subject Assurance Training provided online by the Office of Human Research Protections at: http://137.187.172.153/CBTs/Assurance/login.asp

• You, your spouse, or your dependent children have no financial interest in your project that will or may be reasonably expected to bias the design, conduct, or reporting of your research.
Signature of Principal Investigator:____ Date: _____________________ Title of Project:The Effects of a 90 Minute Soccer Match on Game Related Field Tests

Name of principal investigator: Frank Becerril Telephone: (707)974-7331 Home Address: Email: becerril@sonoma.edu
Department: Kinesiology Title or Academic Status: Graduate Student Co-Investigator(s):

For student investigators only:
Please print or type name of professor or faculty advisor: Dr. Bulent Sokmen
Signature of professor or faculty advisor: ______________________________ Title or Academic Status: Associate Professor Department clearance:
____ Date: ________________
Student investigators must obtain clearance from their department' s human subjects committee, if one exists. Psychology students are required to obtain the signature of the department chairperson.

Protocol Summary Sheet

Last Name:

If requesting Exemption or Expedited Review, specify category
Title of Project:
Fill-enabled Version 8_Revised December 2008*If you have any questions, contact the Office of Research and Sponsored Programs at 664-2448 or email irb@sonoma.edu.*
Fill-enabled Version 8_Revised December 2008
Page 2 of 5
(see http://www.sonoma.edu/aa/orsp/human_subjects.shtml for Appendix B: Research Activities Eligible for Exemption or Expedited Review):
Brief description of purpose of project:
In this study we will analyze 12 college ages soccer players perform 6 game related field tests. We wil observe their performance before, and after a 90-minute soccer match. These tests will evaluate the impact of a match on the subjects anaerobic and aerobic performance. The results of the tests will be compared by the position of the player, and we hope to determine the physical attributes that are necessary for each of the outfield positions.
The Effects of a 90-Minute Soccer Match on Game Related Field Tests
New project Modification
Sub-study Previous study
Date Starting Interaction with Human Subjects: April 2016
End Date: July 2016
Funding Source (if any):

Subjects

Number: 15
Population: Men aged 18-24
Source/How contacted: Announcements, in person, and word-of-mout

Instruments

Check all that apply: Tests Questionnaires Interview guides Other:
Attach one copy of each instrument used. If not yet developed, provide drafts, samples, and/or outlines
How administered:
Telephone Mail or email In person Length and frequency of procedure: Setting:

Data

Check all that apply. Data will be recorded by:
written notes audio tape video tape photography film other: Stopwatch to record time

Data will include:
information which can identify the subject (e.g., name, social codes linked to subjects name by separate code key security number, other unique identifier) specify: codes not linked to subjects names
For items checked above, circle box of those related to data that will be reported
Data will be used for:
publication evaluation needs assessment thesis other: SSU Science Symposium

Informed Consent

written (attach copy of consent form; see http://www.sonoma.edu/aa/orsp/human_subjects.shtml for Appendix A: Informed Consent Guidance)
oral (attach text of statement and request for waiver of written informed consent; see http://www.sonoma.edu/aa/orsp/human_subjects.shtml for Appendix A: Informed Consent Guidance)

THIS SPACE FOR IRB USE ONLY

This project:
¨is exempt under category A- ________ ¨iseligibleforexpeditedreviewundercategoryB- _______
¨requires IRB review
__________________________________ ________________ Human Subjects Administrator Date
__________________________________ ________________ Chair, IRB Date
Comments:
____
____
____
____
____
____

Protocol Requirements

Answer each of the following questions. Use as many pages as necessary to fully respond; most protocols can be covered in five pages or less.
1. What are your research objectives?

The purpose of this study is to determine the physical demands of a 90 minute soccer game on subjects according to the outfield position that they play. Soccer is a very metabolically demanding sport that is played all over the world. It is a complex team sport that involves numerous players participating in a game at the same time; on fields that vary in size depending on the age of the participants. The amount of distance covered during a game corresponds with the position that individual is playing with midfielders covering the most distance out of the outfield positions (Di Salvo et al. 2007; Bloomfield et al. 2007). The movement of the player is also influenced by the team formation, and the tactics of the team (Bangsbo et al. 2006).

Soccer competition is characterized by intermittent physical activities in which sequences of actions requiring a variety of skills of different intensities are strung together (Robineau et. al. 2012), where players need technical, tactical, and physical abilities to succeed (Helgerud et. al. 2001).). Previous studies demonstrated that metabolic demand of soccer is supported by approximately 70% from anaerobic and approximately 30% from aerobic metabolism (Bangsbo et al., 2006; Osgnach et al., 2010). Although soccer is mainly anaerobic, a high level of aerobic fitness is important in helping sustain a high work rate, and assist in rapid recovery between short, intermittent bouts of high intensity efforts during the game (Nassis, G.P. et al 2010; Stolen et al. 2005).

Although, soccer is highly studied sport in research setting, coaches, trainers, and athletes continually search for effective methods to identify and develop physical characteristics that may contribute to sport performance; and a common method of assessing athletic talent is through testing physical ability (Pauole et al 2000). Among these tests, the assessment of repeated-sprint, muscular power, and aerobic fitness are popular among coaches and

applied sport scientists (Rampinini et al 2006). Additionally, player's position on a soccer field often imposes different energy demand throughout a soccer game.
In several studies involving fatigue induced from a 90-minute soccer game, subjects/players are not identified by there position (Robineau et al., 2012; Little et al., 2005; Nassis et al., 2010; Zemlova et al., 2009). Studies that do not acknowledge the different positions on a soccer field are incomplete in their findings. (Bloomfield et al., 2007; Dellal et al., 2012; Di Salvo et al., 2007) have found that the different positions require different ranges of actions, according to where the player is located on the field. Midfielders have been found to cover the most ground; defenders perform the most lateral movement; and forwards execute the most and longest sprints are just some of the actions specified by position (Bloomfield et al., 2007; Dellal et al., 2012; Di Salvo et al., 2007). If we can recognize the specific requirements of each soccer position on a field, we can better understand the metabolic demand placed on each of these positions.
The purpose of this study is to assess the physiological demands placed on a college level soccer players after a 90-minute game; and analyze the impact that a game has on their pre-match physiological assessments. Not only will we be assessing the physiological demands placed on these college soccer players, but we will also compare the player's results based on the position they play on the field. By understanding the physical demands of each position coaches and trainers will be better prepared to create a position specific workout regiment.
Di Salvo, V., Baron, R., Tschan, H., Calderon Montero, F.J., Bachl, N., Pigozzi, F. (2007). Performance characteristics according to playing position in elite soccer. International Journal of Sports Medicine, 28, 222-227.
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Robineau, J., Jouaux, T., Lacroix, M., Babault, N. (2012). Neuromuscular fatigue induced by a 90-minute soccer game modeling. Journal of Strength and Conditioning Research, 26, 555-562.
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Osgnach, C., Poser, F., Bernardini, R., Rinaldo, R., Di Prampero, P.E. (2010). Energy cost and metabolic power in elite soccer: a new match analysis approach. Medicine and Science in Sport and Exercise, 42, 170-178.
Nassis, G.P., Geladas, N.D., Soldatos, Y., Sotiropoulos, A., Bekris, V., Souglis, A. (2010). Relationship between the 20-m multistage shuttle runtest and 2 soccer-specefic field tests for the assessment of aerobic fitness in adult semi- professional soccer players. National Strength and Conditioning Research, 24, 2693-2697.
Stolen, T., Chamari, K., Castagna, C., Wisloff, U. (2005). Physiology of soccer. Sports Med, 35, 501-536.
Pauole, K., Madole, K., Garhammer, J., Lacourse, M., Rozenek, R. (2000). Reliability and validity of the t-test as a measure of agility, leg power, and leg speed in college-aged men and women. Journal of Strength and Conditioning Research, 14, 443-450.

Rampinini, E., Bishop, D., Marcora, S.M., Ferrari Bravo, D., Sassi, R., Impellizzeri, F.M. (2007). Validity of simple field tests as indicatiors of match-related physical performance in top-level professional soccer players. International Journal of Sports Medicine, 28, 228-235.

Dellal, A., Owen, A., Wong, D.P., Krustrup, P., van Exsel, M., Mallo, J. (2012). Technical and physical demands of small vs. large sided games in relation to playing position in elite soccer. Human Movement Science, 31, 957- 969.

2. Discuss the significance and scientific merit of the study.

This project will be a very informative learning experience for both researchers and subjects. This will be valuable information to all coaches and trainers who want tot get thee most out of their athletes. There have been several studies focused on the physical demands from a soccer match; however many of theses studies do not alalyze the subjects according to the position that he or she plays on the field. This research study will benefit coaches and trainers when developing a position specific workout plan. Understanding the physiological load imposed on top-level soccer players according to their positional role during competitive matches is necessary to develop a sport specific training program.

3. In what manner and to what extent will human subjects be involved?

The human subjects are at the core of this research, as the data gathered will be based strictly on their performance of 6 game related field tests. Participants will consist of 15 men who compete on the Sonoma State club soccer team. During the initial session, the participants will be informed of the potential benefits and risks of this study, and given a consent form to read and sign. Following this we will obtain body composition information from each of the subjects including; height, weight, and age. Finally we will inform and demonstrate the proper method to perform each test, and give the subjects the opportunity to familiarize themselves with the testing protocol and equipment.

Test day 1 & 3: Test day 1 the participants will arive at the Sonoma State soccer fields. We will then guide the subjects through a 15 minute general dynamic warm-up, and time to practice the test protocols. They will be given 3 minutes of rest before the start of the first test trial. The first test performed will be the vertical jump test; analyzing muscular power. This test will be performed with subjects feet planted flat on the ground next to the Vertec measuring device. Subjects will be allowed to swing their arms, but a preporatory step will not be permitted. Each subject will perform 4 trials of the vertical jump test with 1 minute of rest between each trial. After finishing the vertical jump test the subjects will be given 15 minutes of rest before beginning trials of the 50 meter sprint test. The sprint test will analzye the leg speed of the subjects. They will begin with one foot on the starting line, and run as fast as they can through 2 sensors 50 meters away. Each subject will perform 2 trials with 3 minutes of rest between each trial. Following the completion of their second trial the subjects will be given 15 minutes of rest before the start of the Yo-Yo beep test. The beep test consists of the subjects running back and forth on a 20 meter course where they will be required to touch the line before changing direction. The initial speed is 8.5 km/h, which gets progressively faster (0.5 km/h every minute), in accordance with a pace dictated by a sound signal on an audiotape. Subjects will keep up their pace with the signal as long as possible. When the subjects can no longer follow the pace of the signal, the last stage that they reached will be used in an equation to predict their maximal oxygen uptake. Only 1 trial will be performed for the beep test. The testing protocol for day 3 is nearly identical to day 1 of the testing. Test day 1 will be viewed as the baseline performance for the subjects, where the subjects will be guided through a general dynamic warm-up. We will be analyzing the subjects post match performance on day 3 of the testing, and on this day the subjects will go directly from the game field to the testing area, with no rest before the start of the field tests.

Test day 2 & 4: Test day 2 the participants will arrive at the Sonoma State soccer fields. We will then guide the subjects through a 15 minute general dynamic warm-up, and time to practice the test protocols. They will be given 3 minutes of rest before the start of the first test trial. The first test performed on this day will be the T- Test, and this will be analyzing the subjects agility. For the T-test the subjects will begin at the starting line, cone A; the will

then sprint forward 10 yards to cone B, where they will toch the cone with their right hand; shuffle to the left 5 yards and touch cone C with their left hand; shuffling to the right 10 yards and touch cone D with their right hand; shuffle to the left back to cone B, and touch it with their left hand; finally the subjects will run backward across the finish line at cone A. For this tests the subjects will perform 3 trials with 3 minutes of rest between each trial. After finishing their third trial, the subjects will be given 15 minutes of rest before starting the repeated sprint test. The repeated spint test consists of 6 repetitions of 25m shuttle sprints combined with 25 seconds of proactive recovery. During recovery subjects jogged slowly back to the starting line and waited for the next sprint. Time trials were recorded using photo-cell gates placed 1 m above the ground. Each subject performed 1 trial of this test, after which subjects are given 15 minutes of rest before starting the 400 meter test. The 400 meter test will be performed on a outdoor track, and each subject will perform 1 trial. Subjects will begin with 1 foot behind the starting line, and run 400 meters as fast as possible through the finish line. Test day 2 will be viewed as the baseline performance for the subjects, where the subjects will be guided through a general dynamic warm-up. We will be analyzing the subjects post match performance on day 4 of testing, and on this day the subjects will go directly from the game field to the testing area, with no rest before the start of the field tests.

4. What procedures, instruments, etc. will be employed?

Instruments to test the effect of a 90-minute soccer match

1. Cones to be used in the 50 meter sprint test, T-test, repeated sprint test, and the Yo-Yo beep

2. Stopwatches to measure the start and stop times of each of the running tests that the subjects will perform 3. Vertec measuring device to be used during the vertical jump test.

4. Stereo to be used during the beep test

5. Photo sensors to be used for the sprint and T-test

5. What existing data, if any, will be used?

None

6. What will the subjects be told about their involvement in the study?

The subjects will be told the exact procedures as well as the objective of they study we are performing.

7. Describe the procedures for obtaining and recording the informed consent of subjects. Attach a copy of the consent form if written consent is planned. If oral consent is planned, attach a copy of the text of the statement and a request for waiver of written consent.

Those participating in the study will sit down with investigators in order to go over the printed written consent form, and they will sign and return it at that time.

8. Describe any potential risks to the subjects, including psychological stress and physical hazards. How are these risks outweighed by the sum of the benefits to the subjects and the importance of the knowledge to be gained?

There is always a potential physical risk involved when dealing with human subjects and exercise. Our study will put stress on the joints and muscles as well as the cardiovascular system of the subjects. The risk of this study can be outweighed by the potential benefits.

9. Describe any interventions or manipulations of subjects or their environments.

There is no manipulation of the subjects for this study. There will be manipulation of the enviornment by setting up field tests that mimic similar movements that subjects perform while playing soccer.

10. What measures will be taken to safeguard the welfare of subjects, their right to privacy and confidentiality of information?

The subjects will always have the ability to back out of the research if they chose to do so. To ensure the safety of the subjects, all testing procedures will be monitored by investigators. There will be no private personal information necessary for this study from the subjects, however any information obtained in regard to the study will be noted by code.

11. Are school-age children or other minors to be involved? If so, please describe the subject population.

No

12. Are psychological tests to be used? If so, please name them.

No

13. Describe the debriefing of subjects. What steps will be taken to deal with the after-effects of emotional stress resulting from the research procedure?

There are no foreseen causes of emotional distress for participants due to the main component of this study being exercise protocols widely used in exercise science.

14. What procedures will be taken to insure prompt reporting of (a) proposed changes in the activity, (b) any
unanticipated problems involving risks to the subjects or others, (c) any injury to subjects, and (d) any non-
compliance with policies and procedures?

Because the protocols of the reasearch must provide valid measurements pertaining to participants' performance, we do not anticipate any changes in the activity. Should there be any changes, the study design will be amended and the Institutional Review Board will be notified immediately. In the case of any policies and procedures, Dr. Bülent Sökmen will resport them according to both departmental and university protocols. An accident report will also be filed if it pertains to the situation as well.

15. What type of remuneration, if any, will be offered to subjects for their participation in the research?

There will be no direct benefits for the subjects participation in this study. We hope that this may give them a new experience as well as inspire to learn more.

Appendix B:

Sonoma State University

Informed Consent Form for Research Involving Human Subjects

You are invited to participate in a study, “Does positioning on the field require different physiological demand and capacity in soccer players?,” being conducted by Frank Becerril. The purpose of this study is to compare the subject’s results based on soccer position before and after a full 90-min soccer match. We will be able to investigate if a game-like 90-minute soccer match has similar physiological stress and fatigue on aerobic and anaerobic system by pre and post testing on: 1) vertical jump, 2) 50-meter sprint test, 3) beep test, 4) t-test, 5) repeated sprint ability test, and 6) 400-meter sprint test.

You were chosen as a possible participant in this study because you fit the following criteria:

1) Players aged between 18-24 with 7-10 years of soccer experience.
2) Apparently healthy no know cardiovascular, metabolic, and pulmonary diseases.
3) No injuries from health limitations affecting the ability to perform jump, sprint, and change of direction intervals; as well as participate in game-like 90- minute soccer matches.

If you decide to partake in the study, you will be required to visit the practice soccer field, and track stadium at Sonoma State University a total of four visits over the course of 4 to 6 weeks, with visit 1 and 2 taking about 60 minutes and visit 3 and 4 taking approximately 150 minutes. Your total time commitment will be about 7 hours. All visits will take place at the practice soccer field as well as for visit 2 and 4 will meet at outdoor track stadium.

First session: The purpose of the first session is: 1) to make sure you are eligible to partake in the testing protocols and that it is safe for you to complete jump, sprint, and change of direction intervals as well as participate in full 90-minute soccer matches, 2) to attain your written consent if you are eligible, 3) to familiarize you with the testing protocols, and 4) to determine your body composition, age, height, and weight. Primarily, we will go through this form with you to make sure you comprehend the expectations for this study; making sure each of you is healthy and prepared to participate. After acquiring written consent, we will clarify and demonstrate in further detail the testing protocols. When this is clarified and understood, we will start baseline testing. The human subjects are at the core of this research, as the data gathered will be based strictly on their performance of 6 game related field tests. Subjects will consist of 15 men who compete on the Sonoma State varsity and club soccer team. During the initial session, the participants will be informed of the possible benefits and risks of this study, and given a consent form to read and sign. Following this we will obtain body composition information from each of the subjects including; height, weight, and age. Finally we will inform and demonstrate the proper technique to perform each test, and give the subjects the chance to familiarize themselves with the testing protocol and equipment.

Test day 1 & 3: Test day 1 the participants will arive at the Sonoma State soccer fields. We will then guide the subjects through a 15 minute general dynamic warm-up, and time to practice the test protocols. They will be given 3 minutes of rest before the start of the first test trial. The first test performed will be the vertical jump test; analyzing muscular power. This test will be performed with subjects feet planted flat on the ground next to the Vertec measuring device. Subjects will be allowed to swing their arms, but a preporatory step will not be permitted. Each subject will perform 4 trials of the vertical jump test with 1 minute of rest between each trial. After finishing the vertical jump test the subjects will be given 15 minutes of rest before beginning trials of the 50 meter sprint test. The sprint test will analzye the leg speed of the subjects. They will begin with one foot on the starting line, and run as fast as they can through 2 sensors 50 meters away. Each subject will perform 2 trials with 3 minutes of rest between each trial. Following the completion of their second trial the subjects will be given 15 minutes of rest before the start of the Yo-Yo beep test. The beep test consists of the subjects running back and forth on a 20 meter course where they will be required to touch the line before changing direction. The initial speed is 8.5 km/h, which gets progressively faster (0.5 km/h every minute), in accordance with a pace dictated by a sound signal on an audiotape. Subjects will keep up their pace with the signal as long as possible. When the subjects can no longer follow the pace of the signal, the last stage that they reached will be used in an equation to predict their maximal oxygen uptake. Only 1 trial will be performed for the beep test. The testing protocol for day 3 is nearly identical to day 1 of the testing. Test day 1 will be viewed as the baseline performance for the subjects, where the subjects will be guided through a general dynamic warm-up. We will be analyzing the subjects post match performance on day 3 of the testing, and on this day the subjects will go directly from the game field to the testing area, with no rest before the start of the field tests.

Test day 2 & 4: Test day 2 the participants will arrive at the Sonoma State soccer fields. We will then guide the subjects through a 15 minute general dynamic warm-up, and time to practice the test protocols. They will be given 3 minutes of rest before the start of the first test trial. The first test performed on this day will be the T-Test, and this will be analyzing the subjects agility. For the T-test the subjects will begin at the starting line, cone A; the will then sprint forward 10 yards to cone B, where they will toch the cone with their right hand; shuffle to the left 5 yards and touch cone C with their left hand; shuffling to the right 10 yards and touch cone D with their right hand; shuffle to the left back to cone B, and touch it with their left hand; finally the subjects will run backward across the finish line at cone A. For this tests the subjects will perform 3 trials with 3 minutes of rest between each trial. After finishing their third trial, the subjects will be given 15 minutes of rest before starting the repeated sprint test. The repeated spint test consists of 6 repetitions of 25m shuttle sprints combined with 25 seconds of proactive recovery. During recovery subjects jogged slowly back to the starting line and waited for the next sprint. Time trials were recorded using photo-cell gates placed 1 m above the ground. Each subject performed 1 trial of this test, after which subjects are given 15 minutes of rest before starting the 400 meter test. The 400 meter test will be performed on a outdoor track, and each subject will perform 1 trial. Subjects will begin with 1 foot behind the starting line, and run 400 meters as fast as possible through the finish line. Test day 2 will be viewed as the baseline performance for the subjects, where the subjects will be guided through a general dynamic warm-up. We will be analyzing the subjects post match performance on day 4 of testing, and on this day the subjects will go directly from the game field to the testing area, with no rest before the start of the field tests.

This research is designed to help coaches and contribute to scholarly knowledge regarding physiological and metabolic demand of a 90-minute soccer match on players, in relation to position. We do not promise that participants will obtain any benefits from this study. At the conclusion of this study, a summary of results and personal data will be provided to you upon demand. The outcomes are valid only if the testing protocols are followed as described for all participants.

Confidentiality: All information acquired in relation with this study that can be identified with you will remain classified and will be released only with your permission or as required by law. Your name and other information that could recognize you will not be exposed to anyone outside the research team at anytime. If you give us your authorization by signing this document, we plan to release no personal information, and to cite composed data in the total only.

Benefits: You will be provided with free water before and at the end of second half of full 90-min match. Results of this study may provide you with information on how to create appropriate training programs to be successful in soccer.

Risks: Performing exercise and participating in a game-like situation holds the risk of injury (muscle strain, cramps, and tears) or cardiovascular effects (loss of consciousness, heart attack, stroke, chest pain). If an injury occurs, medical assistance may be attained at the Sonoma State Student Health Center. If you are physically injured during participation in this study, you can call 707-664-2166 at Sonoma State University for information on filling a claim.

Your decision whether or not to partake will not affect your future associations with Sonoma State University. If you decide to participate, you are free to withdraw your permission and to cease participation at any time without discrimination.

If you have any questions, please get in contact with us. Dr. Bulent Sokmen at (707)-664-2789 or sokmen@sonoma.edu. Frank Becerril at (707)-974-7331 or becerril@sonoma.edu. You will be given a duplicate of this form.

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE

Statement of Age and Consent

I state that I am 18 years of age or older and wish to participate in a research study being conducted by Cory Taufer and Dr. Bulent Sokmen, Department of Kinesiology at Sonoma State University. If I am under the age of 18 I will provide a parent signature to participate.

Participant's Signature:_______________________

Date:__________

Participant's Name (Print):_____________________

Investigator’s Signature:_________________________
Date:__________

Investigator’s Name (Print):______________________

Witness’s Signature:____________________________
Date:__________

Witness’s Name (Print):__________________________

Appendix C:

EXERCISE RISK ASSESSMENT

Name ________________________________ Gender __________ Age _______ Email address ____ Phone ____

Please provide the following information as accurately and completely as possible so that it can be used to assess your cardiovascular exercise risk.

Known Cardiovascular, Pulmonary or Metabolic Disease

Have you been diagnosed with any of the following diseases/disorders/conditions or had any of the following procedures?

□Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No

Myocardial infarction ("heart attack") ___________________________________ Stroke or ischemic attack ("mini-stroke") ________________________________ Heart bypass surgery or other heart surgery ______________________________ Coronary catheterization and/or angioplasty ______________________________ Abnormal ECG (tachycardia, heart block, etc.) ____________________________ Other cardiovascular disease/disorder (aneurysm, etc.) ______________________ Chronic obstructive lung disease (asthma, COPD, etc.) ______________________ Diabetes (insulin dependent, non-insulin dependent) ________________________ Hyperlipidemia (high LDL, low HDL, etc.) ________________________________

Comment:
____
____
____

Signs or Symptoms Suggestive of Cardiovascular and Pulmonary Disease

Have you experienced any of the following?

□Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No

Pain/discomfort in your chest, jaw or arms _______________________________ Shortness of breath at rest or mild exertion _______________________________ Dizziness or fainting spells ____ Difficulty breathing while lying down ____________________________________ Swelling of your ankles ____ Skipped heart beats or a racing heart beat ________________________________ Occasional leg pain, especially while walking _____________________________ Heart murmur ____ Fatigue or shortness of breath with usual activities __________________________

Comment:
____
____
____

Risk Factors of Cardiovascular Disease

Do you have a personal history of any of the following?

□Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No □Yes □No

Cigarette smoking: packs/day ______, years smoked ________
Obese or highly overweight: body weight ____________
Physical inactivity: ____ High blood pressure (SBP>140, DBP>90), BP ________________ mmHg
High cholesterol (total>200, LDL>130): total _________, LDL _________ mg/dl Diabetes or high blood glucose (>110): blood glucose ______________ mg/dl Family history of heart attack/stroke at young age: ______________________

Comment: ____
____

Drugs/Medications

Please list any prescription or over the counter drugs/medications you are currently taking.

Drug / medication ____________________________ ____________________________
____

Purpose / reason for taking ____
____
____

Classification of Exercise Risk *(ACSM Guidelines)*

□ **Low Risk:** Free of cardiovascular, pulmonary and metabolic disease; and free of any signs or symptoms of cardiovascular disease; and possess no more than 1 major risk factor of cardiovascular disease; and male ″ 45 y, female ″ 55 y

□ **Moderate Risk (age):** Free of cardiovascular, pulmonary and metabolic disease; and free of any signs or symptoms of cardiovascular disease; and possess no more than 1 major risk factor of cardiovascular disease; and male > 45 y, female > 55 y

□ **Moderate Risk (risk factors):** Free of cardiovascular, pulmonary and metabolic disease; free of any signs or symptoms of cardiovascular disease; regardless of age; possess 2 or more major risk factors of cardiovascular disease

□ **HIgh Risk:** Regardless of age; diagnosed with cardiovascular, pulmonary or metabolic disease; or possess any signs or symptoms of cardiovascular disease

Participants in the ***low risk*** category can participate in maximal intensity exercise with little risk of cardiovascular problems (e.g., arrhythmia, etc.). It is not necessary that they get medical clearance prior to participating in exercise or any lab test.

Participants in the ***moderate risk*** category have a somewhat higher risk of experiencing cardiovascular problems with vigorous (>60% VO_2max) to maximal exercise intensity. ACSM recommends anyone in the moderate risk category get medical clearance prior to vigorous exercise. Lower intensity exercise (<60% VO_2max) poses less cardiovascular risk and can be done without prior medical clearance.

ACSM recommends that participants in the ***high risk*** category get medical clearance prior to participating in any type of exercise test or exercise program.

Reference: American College of Sports Medicine (2006). *ACSM's Guidelines for Exercise Testing and Prescription, 7th edition.* Philadelphia: Lippincott, Williams & Wilkins.

In Case of Emergency

Name ______________________________ Phone ______________________________