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The Impact of Pre-Performance Anxiety on VO_2Peak Values in Female Collegiate Soccer Players

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An Honors Thesis

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The Impact of Pre-Performance Anxiety on VO_2peak values in Female Collegiate Soccer Players

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ABSTRACT
Peak oxygen consumption (VO_2peak) testing is commonly performed to assess endurance training effectiveness in athletes, including soccer players. However, how variables such as playing position, training type (off-vs. in-season), and performance anxiety levels affect maximal exercise capacity have not been determined. **PURPOSE:** The aim of this study was to determine the effect of positioning, training type, and pre-performance directional anxiety on VO_2 max values in female soccer players. **METHODS:** Sixteen female collegiate soccer players completed two trials using a cycle ergometer. VO_2peak was determined by the participant's inability to continue pedaling and/or an established plateau in VO_2 despite increasing workload. Prior to testing, a Competitive State Anxiety Inventory (CSAI-2) was completed to determine somatic anxiety, cognitive anxiety, and self-confidence. **RESULTS:** No significant differences were found between VO_2peak and positioning, training type, and pre-performance directional anxiety ($p=0.085$, $p=0.115$, $p=0.244$ respectively). However, a strong correlation was found between somatic and cognitive anxiety ($r^2= 0.736$, $p=0.079$). **CONCLUSION:** VO_2peak values were not affected by positioning type in female collegiate soccer players. High and low levels of anxiety did not predict maximal performance capabilities; however, somatic and cognitive anxiety positively interacted in determining performance. To better characterize performance anxiety in the future, research could examine cortisol levels prior to maximal performance.

Key words: VO_2*peak, anxiety, directional anxiety, somatic anxiety, cognitive anxiety, CSAI-2*

INTRODUCTION The human body can undoubtedly do amazing things. During a 90-minute soccer game, professional athletes ultimately make perpetual running appear effortless. An average elite soccer player runs 8-12 km (5-7 miles) per game at high intensity bouts (12). This accomplishment is often attributed to one's aerobic fitness. Aerobic fitness is commonly defined as the efficiency of one's body to use oxygen to produce energy for long periods of time. To quantify aerobic fitness, researchers often use a VO_2max test because it is considered an important factor in determining success in an endurance sport (12). VO_2 max is crucial to aerobic sports because it defines the limits of the cardiorespiratory system by measuring the optimal oxygen uptake attained during maximal exercise (1,11). Therefore, this approach to testing is often considered a good indicator of physical fitness in female soccer players.

When conducting research on aerobic fitness, Hill and Lupton (1923) discovered that subjects will reach a plateau even when the speed of running continuously increases. A plateau represents an individual's maximum oxygen limit, VO_2max (11). VO_2max is comprised of the Fick Equation, VO_2= Q x AVO_2 difference. Q corresponds to cardiac output, which consists of heart rate (HR) and stroke volume (SV). HR is defined as the number of heartbeats per minute and SV is defined as the amount of blood ejected per beat. AVO_2 corresponds to the difference in arterial and venous O_2. Together, VO_2 max functions as a good predictor of heart efficiency and tissue extraction of O_2. Therefore, VO_2 max is dependent upon the development of both the cardiovascular and pulmonary systems, making maximal oxygen consumption a key indicator of cardiovascular fitness (1). Based on previous studies, values from average female soccer athletes range from 47 mL/kg/min to 58 mL/kg/min. (18). VO_2peak assessed and referred to in this study is the highest value achieved in a VO_2max test. The criteria used for determination of

VO_2 plateau after increased workload over time required a respiratory exchange ratio greater than 1.5.

Another component to cardiovascular performance in soccer players is based on soccer position. Each individual position usually varies by intensity and/or duration of aerobic fitness. More movement on the field is often correlated to increased endurance capabilities (2,16). A study conducted by Bloomfield (2007) found supporting evidence that midfielders covered the greatest overall distances on the field (17). Additionally, a study conducted with the Texas A&M soccer team, determined midfielders to have the highest relative average VO_2 max score at 50.90 mL/kg/min, while goalkeepers displayed the lowest average relative score at 43.45 mL/kg/min (17). However, conflicting studies have observed no significant differences between positions (9).

Like positioning, fitness in the game of soccer is strikingly inconsistent based on a large number of unpredictable movements. The ability to replicate such a large array of movement can make training decisions difficult. Anaerobic training helps to enhance muscle lactate removal and anaerobic capacity of muscles. Aerobic training helps to enhance maximal oxidative capacity and the blood's capacity to deliver O_2. Some research provided evidence that soccer specific aerobic training showed effectively developed VO_2max values, corresponding to good soccer performance (11). Therefore, high intensity training through soccer could produce advantageous aerobic results through game-like enhancement of optimal oxygen uptake (1,11). However, studies have also shown the necessary function of anaerobic fitness for soccer. This type of fitness becomes crucial when a sprint occurs at approximately every 90 seconds in a soccer game (15). Additionally, to be adequately capable of cutting, tackling, and turning requires quick burst of energy. Therefore, an individual's anaerobic fitness in soccer is crucial, especially where pertinent goal-scoring and/or goal-saving plays require quick adjustments in speed or position. Difficulty in implementing a training type can be due to the multiple facets of speed, endurance, strength, and balance required in the sport of soccer. This present study examined the differences between sport specific training (in-season) and aerobic and anaerobic training (off-season). To categorize training type, off-season training was classified as anaerobic and aerobic fitness and in-season training was classified as sport specific training. An off-season training program was designed in collaboration with both the university's track and field coach and the strength and conditioning coach. Sport specific training consisted of soccer specific activities during practices and games designed by the coaching staff.

Beyond physical fitness, it is also important to consider psychological factors that might impede an individual's aerobic and anaerobic performance. Directional anxiety in competition refers to the degree that anxiety facilitates or debilitates performance. Prior to competition, athletes may experience a term known as competitive state anxiety. This refers to a temporary, ever-changing emotional state of subjective, consciously perceived feelings of apprehension and tension, associated with activation of the autonomic nervous system, made up of cognitive and somatic anxiety (3,13). Both cognitive and somatic anxiety are important in understanding how an individual perceives anxiety symptoms to either facilitate or hinder performance (13). Cognitive anxiety concerns the degree to which one worries or has negative thoughts. Somatic anxiety concerns the moment-to-moment changes in perceived physiological activation through perception (3, 17). Research remains inconclusive in determining how direction and type of anxiety functions with performance. However, several studies have used a multidimensional assessment called the Competitive State Anxiety Inventory (CSAI) to determine an individual's direction of anxiety (3,16). This approach is used to interpret the way specific thought processes affect outcomes. The CSAI provides insight into how an athlete processes cognitive information, the strategies they use, and how it affects their performance and confidence (17,18). The CSAI also examines how athletes cope with somatic anxiety responses such as rapid heart rate, shortness of breath, and stomach aches (18). Individuals with cognitive personal control have shown to have positive performance and higher self-confidence (18). This evidence supported a multidimensional anxiety theory predicting cognitive anxiety negatively affecting performance but somatic anxiety relating to performance in an inverted U manner as displayed below in Image 1 (3,18). The scores are divided into cognitive, somatic, and self-confident scores. Athletes that score high are usually classified as highly anxious individuals. Athletes who score in the middle are considered moderately anxious and low scores are lowly anxious individuals.

The purpose of this study was to determine the effect VO_2peak values have on soccer position, training type, and pre-performance directional anxiety. It was hypothesized that VO_2peak would have an inverted-U relationship with all three anxiety factors. In relation to training type, off-season training was predicted to produce greater VO_2peak values than in-season training. Additionally, it was hypothesized VO_2peak would differ by positioning and that midfielders would have the highest value because of duration of time spent continuously running.

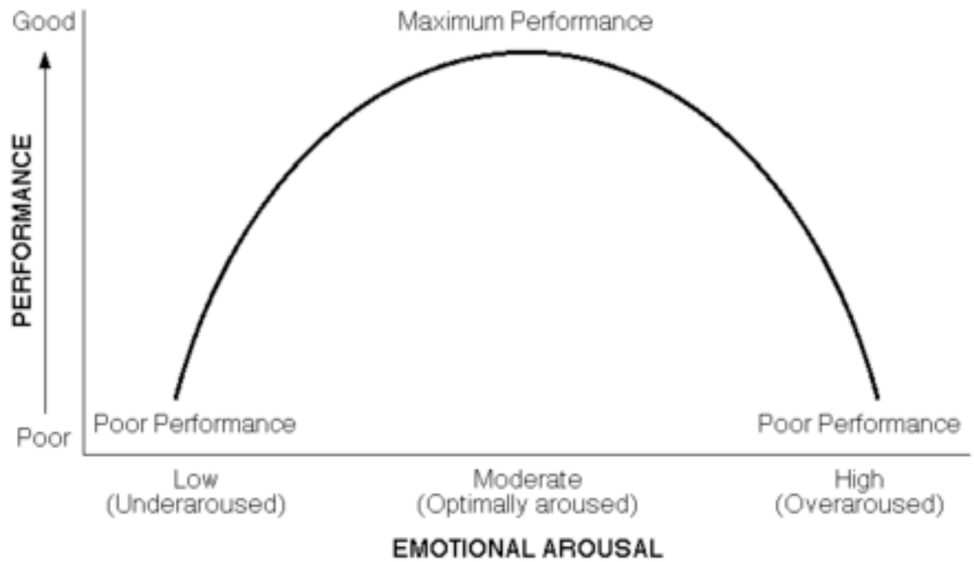

Image: ExRx.net

Image 1. Displays the inverted U-hypothesis proposed by many sports psychologists in relation to performance and anxiety (Jones et al., 2001).

METHODS

Experimental Approach to The Problem

The time of day for testing was not controlled, but completed between the hours of 8:00am-8:00pm. The trials were completed roughly every three months, over a nine-month period. The timing of trials was chosen based on spring training, season start date, and playoff results. All subjects reported to the laboratory before the start of maximal oxygen consumption (VO_2peak) trials and were weighed, measured, and fitted with a heart rate monitor. A Velotron Cycle Ergometer was used to perform testing with an established protocol, consisting of a 4-minute warm up at 75W with 2-minute stages increasing workload by 35W until reaching 200W. Once an individual had reached 200W, the workload increased by 10W every minute. The protocol described above is shown in Table 2. Workload would continue to increase until the subject could not physically pedal or had established a VO_2 plateau despite increasing workload. VO_2peak was measured using Cardiocoach software system. Breathing through the Hans Rudolph valve, the subject's expired gases were collected in a chamber of oxygen and carbon dioxide. Oxygen consumption, CO_2 production, and respiratory exchange ratio were collected every 15 s for calculations directed to a computer. Air circulated throughout the room with a fan to decrease thermal stress during testing. The investigators verbally encouraged participants during testing for motivation. Prior to the next trial, participants were requested to follow the same pattern of exercise and dietary consumption for one-day prior, as they did leading up to the first trial.

Table 1. Protocol for Velotron Cycle Ergometer VO_2***peak testing***

Time (minutes)	Wattage (W)
0-5	75
5-7	110
7-9	140
10-11	170
11-12	200
12-13	225
13-14	250
14-15	275

Subjects Sixteen healthy, NCAA Division III, female soccer athletes between the ages of 18-22 completed the study. The subject's characteristics are displayed in Table 1.To be classified as healthy, subjects were required to be physically able to participate in half (9 out 18 games) of the regular season. Potential subjects were first screened with an electrocardiogram (ECG) to determine any cardiac abnormalities that would exclude them from maximal exercise testing. Subjects who were excluded from the study did not meet playing requirements or had inadequate health for maximal exercise. A total of 23 participants were enrolled for the study. Nine participants completed baseline and both trials. Baselines were not used for the study based on limited data. Seven participants did not complete baseline but completed both trials. Seven subjects voluntarily withdrew during the study due to personal reason, illness, and/or injury. All subjects provided voluntary and informed written consent. Hamline University's Institutional Review Board approved the study.

Table 2. Participant characteristics based on mean results from trials 1 and 2.

Characteristics	Values (Mean ± SD)
Age (y)	19±1.3
Number of participants by position (forward, midfield, defense)	3, 7, 5
Height (cm)	167±6.4
Weight (kg)	62±5.7
BMI (kg/m^2)	22±2.7

Values are expressed as mean ± SD.

Procedures

VO_2Peak Testing

Measurements were taken within two weeks prior to season and after season. Baseline assessments were completed three months prior to trial 1. Maximal testing increments are displayed above in Table 2. The protocol for testing is described above.

Competitive State Anxiety (CSAI-2)

The CSAI-2 is a frequently used assessment to examine anxiety in sports psychology research. A CSAI-2 was administered before each trial to determine how directional anxiety predicts fitness testing performance (15). Self-confidence, somatic anxiety, and cognitive anxiety were measured in response to blanket statements about current feelings. A sample item would be "I feel nervous." The inventory consisted of 27 questions with responses to items based on the Likert scale ranging from 1 (not at all) to 4 (very much so). The score for each subcategory ranged from 9 to 36. Scores correlate to classification of anxious traits. Athletes that score high were classified as highly anxious athletes. Athletes with middle scores were classified as moderately anxious and low scores were classified as lowly anxious.

Heart Rate Recovery (HRR)

After testing concluded, the subject's heart rate (HR) was recorded. After one minute of recovery, the subject's HR was recorded once again. The two HR values were used to determine the subject's heart rate recovery (HRR). To measure HRR, the initial heart rate after testing was subtracted from the heart rate reported after one minute of recovery. HRR was determined after each trial and then averaged. HRR is often used as another indicator of one's physical fitness following maximal exercise.

Heart Rate (HR) and Rating of Perceived Exertion (RPE)

Using a Polar heart rate monitor, HR was measured every 15s during the trial and every 15s during the recovery phase. Participants were asked to continue biking after testing at 80W for a recovery period. After 1-minute of recovery, HR was collected once again to analyze HRR after testing. Subjective ratings of perceived exertion ratings on a Borg Scale (ranging from 1 to 10) were recorded at every one-minute stage of testing, syncing along with heart rate collection.

Training Type

Training type was classified by two methods throughout the course of nine months. Off-season training consisted of anaerobic and aerobic fitness (Table 3). The university's cross country/ track and field coach created the off-season anaerobic and aerobic fitness program. To complement the previously described off-season program, the team's strength and conditioning coach created an anaerobic fitness program. Both programs were used prior to trial 1. The in-season training that occurred before Trial 2 consisted of soccer specific training (practices and games) that was designed by the team coaching staff as shown in Table 4.

Table 3. Aerobic and Anaerobic Off-season Training Completed Before Trial 1

Monday	Tuesday	Wednesday	Thursday	Friday/Saturday/Sunday
Lifting (back squat, hang clean, bench, plyometrics)	Aerobic Workout (2-4 miles)	Lifting (back squat, hang clean, bench, plyometrics)	Aerobic and Anaerobic Workout (2 miles, HIT)	Optional Extra Run (2-4 miles)

Table 4. Sport Specific In-season Training Completed Before Trial 2

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Practice 3:30-6:00	90- Min Game	Practice 4:00-6:30	Practice 3:30-6:30	Practice 5:00-6:30	90-Min Game	Day off

Statistical Analysis

Data was analyzed using SPSS version 16.0 statistical software and 2016 Microsoft Excel. Average VO_2peak and positioning were analyzed using a one-way analysis of variance for repeated measures (ANOVA). Average VO_2peak, training type, pre-performance anxiety (somatic, cognitive, and self-confidence) by trial and HRR were analyzed using paired t-tests. A linear regression model was used for correlational analysis of VO_2peak with all other dependent variables (BMI, height, weight, age, HRR, somatic anxiety, cognitive anxiety, and self-confidence). For linear regression, R-values of -1.0 to -0.5 or 1.0 to 0.5 represented a strong correlation, -0.5 to -0.3 or 0.3 to 0.5 represented a moderate correlation, and -0.3 to -0.1 or 0.1 to 0.3 represented a weak correlation. A p value ≤ 0.05 was used to determine statistical significance.

RESULTS

VO_2Peak Trials

VO_2 max and position are shown in Figure 1. Average VO_2values were not significant across individuals who play different positions. Forwards averaged the highest VO_2values at 43.41.7 mL/kg/min, followed by midfielders at 38 3.9 mL/kg/min. The lowest values performed were from defenders at 37.63.4. With a p-value of 0.085, no difference was determined between positioning and VO_2 peak performance. While there was no significant difference between variables both trended towards significance. No significant difference was determined between off-season and in-season values based on a p value of 0.115. Average VO_2peak off-season values were slightly lower at 384.2 mL/kg/min, whereas, in-season average was slightly higher at 405.0 mL/kg/min. The relationship between each participant VO_2peak values based on training is displayed in figure 2. HRR and VO_2values were not significant based on a p value 0.05. All mean results are displayed in table 5 and all p values and correlation coefficients from the study are displayed in Table 6.

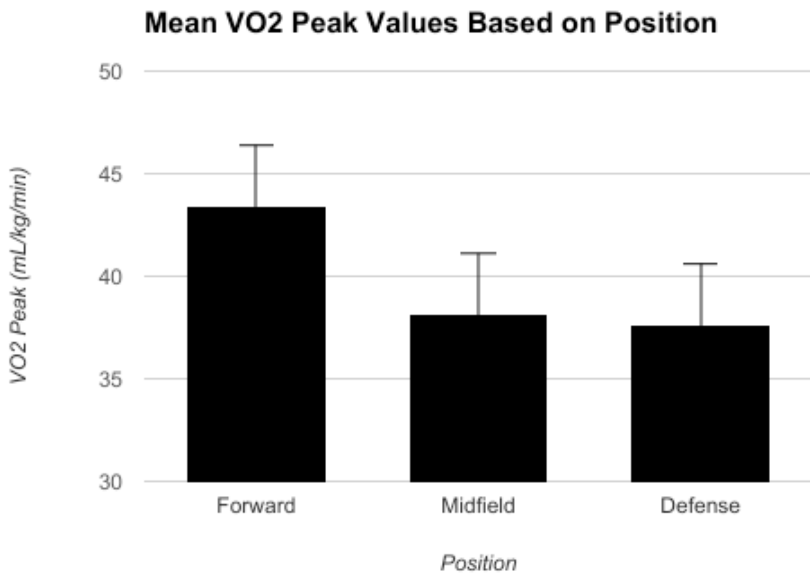

Figure 1. Differences in VO_2***peak values based on position type. The values are mean (mL/kg/min)*** **± SD.** ***A one-way ANOVA was used to determine significance based on three independent position groups. No significance difference was found between positioning and*** VO_2***peak, however, both variables approached significance with a p value of 0.085.***

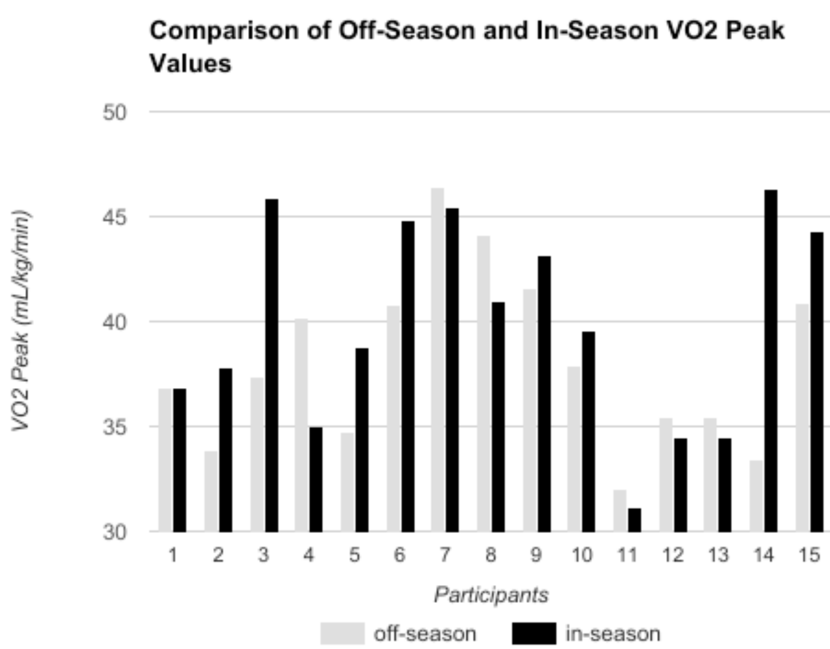

Figure 2. Differences between participant in-season and off-season VO_2***peak values. Using a paired t-test, no significant difference was found between off-season and in-season training type with a p value of 0.115.***

Table 5. Mean Results of Dependent Variables

Dependent Variables	Mean ± SD
Off-season VO_2peak (mL/kg/min)	38±4.2
In-season VO_2peak (mL/kg/min)	40±5.0
Off-Season Somatic Anxiety (scale 9 to 36)	14±4.7
Off-Season Cognitive Anxiety (scale 9 to 36)	15±4.3
Off-Season Self-Confidence (scale 9 to 36)	24.6±7.0
In-Season Somatic Anxiety (scale 9 to 36)	14.0±3.9
In-Season Cognitive Anxiety (scale 9 to 36)	14.9±2.9
In-Season Self-Confidence (scale 9 to 36)	23.6±5.0
HRR (bpm)	31±12.3
Max HR (bpm)	181±11.2

Values are expressed as mean ± SD.

Table 6. Relationship Between Dependent Variables of Interest and VO_2peak

Dependent Variable	p-value	R^2 value	Test Used
Position	0.085	-----------	One-Way ANOVA
Training type	0.115	-----------	Paired T-test
HRR	0.247	0.455	Linear Regression
Somatic Anxiety	0.220	0.367	Linear Regression
Cognitive Anxiety	0.079	0.736	Linear Regression
Self-Confidence	0.240	0.045	Linear Regression

Values are expressed as mean ± SD. No significant difference between variables, however, position and cognitive anxiety approached significance.

Competitive State Anxiety

Based on a linear regression model, an R coefficient was calculated between VO_2peak and all three dependent anxiety factors. With p values of 0.220, 0.079, and 0.240, there was no significant difference or correlation between VO_2peak values and anxiety subcomponents (Figure 5, 6, and 7). However, both cognitive anxiety scores and VO_2peak values approached significance with a p-value of 0.079. There was no significant difference in anxiety subcomponent scores between trials (Figure 3). Cognitive anxiety was strongly correlated to somatic anxiety with an r^2 value of 0.736 and with a significant p-value of 0.042 (Figure 4).

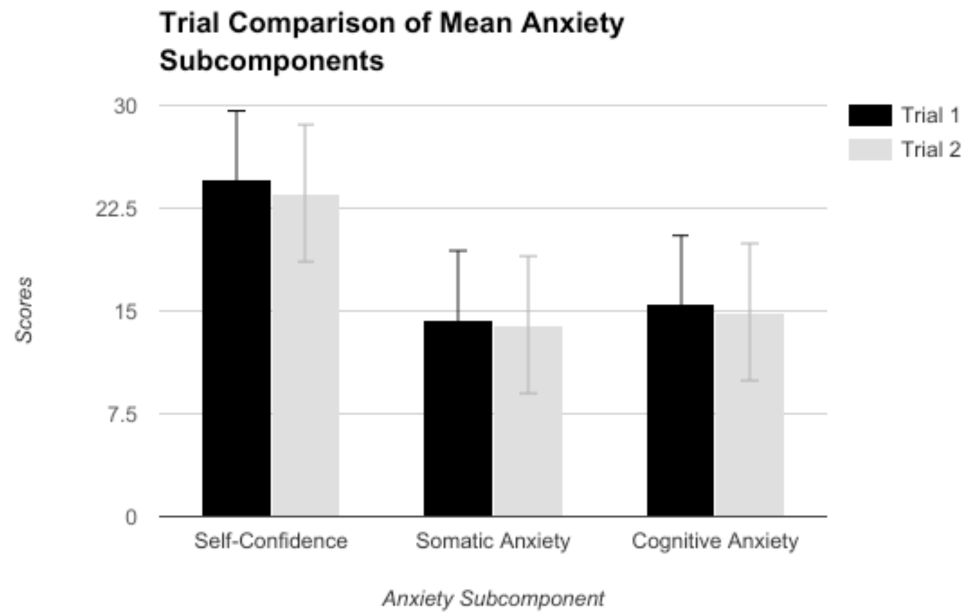

Figure 3. Differences between mean anxiety subcomponent scores prior to both trials. The values are mean ± SD. For each anxiety subcomponent, scores did decrease from trial 1 to trial 2. However, no significant difference was found between trial 1 and trial 2 after using a paired t-test with p-values of 0.940, 0.592, and 0.780.

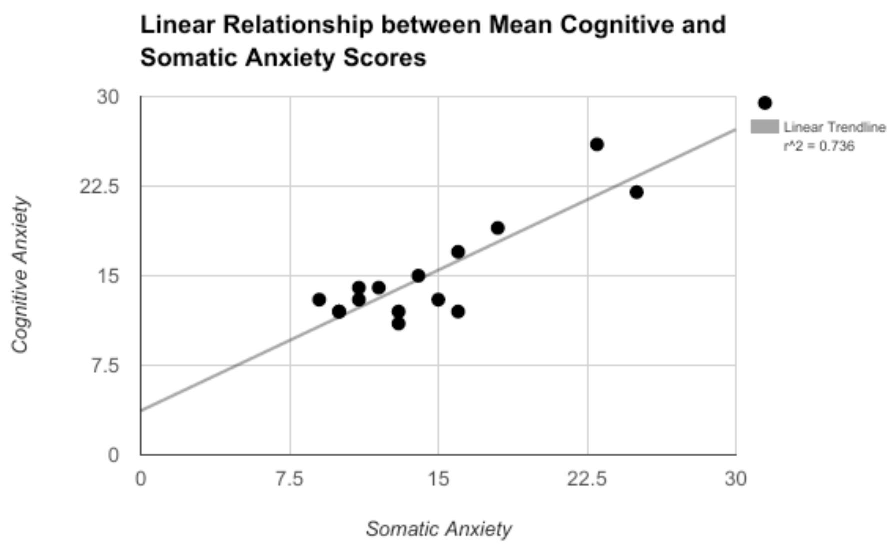

Figure 4. ***Correlation between somatic anxiety and cognitive anxiety. Values are the mean score from both trials. A strong positive correlation is shown based on an r^2 value of 0.736 and with a significant p-value of 0.042.***

Figure 5. Displays the correlation between cognitive anxiety and VO_2peak values. Both variables had a p-value of 0.079 and r^2 value of 0.411. An inverted-U shaped trend line was added to examine the relationship between variables as proposed by sport psychologists.

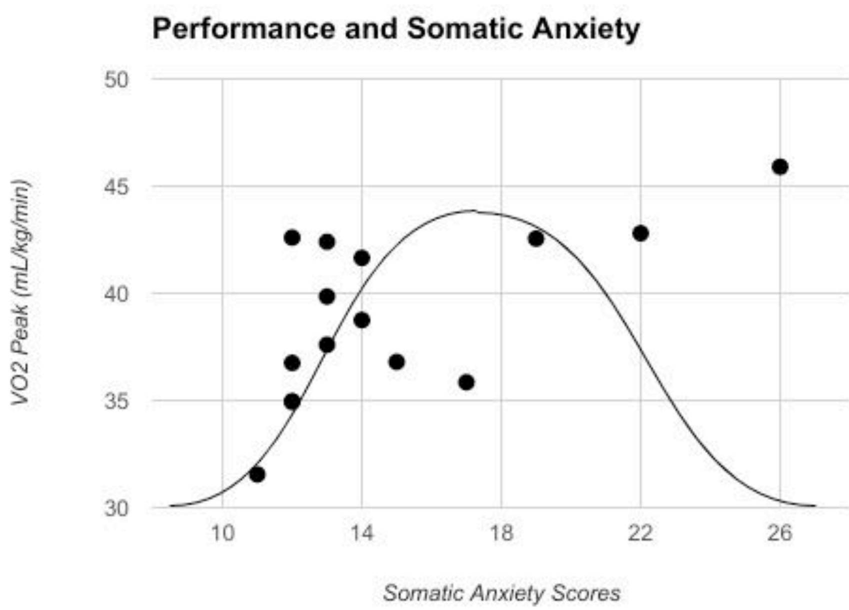

Figure 6. Displays the correlation between somatic anxiety and VO_2peak values. Both variables had a p-value of 0.220 and r^2 value of 0.367. An inverted-U shaped trend line was added to examine the relationship between variables.

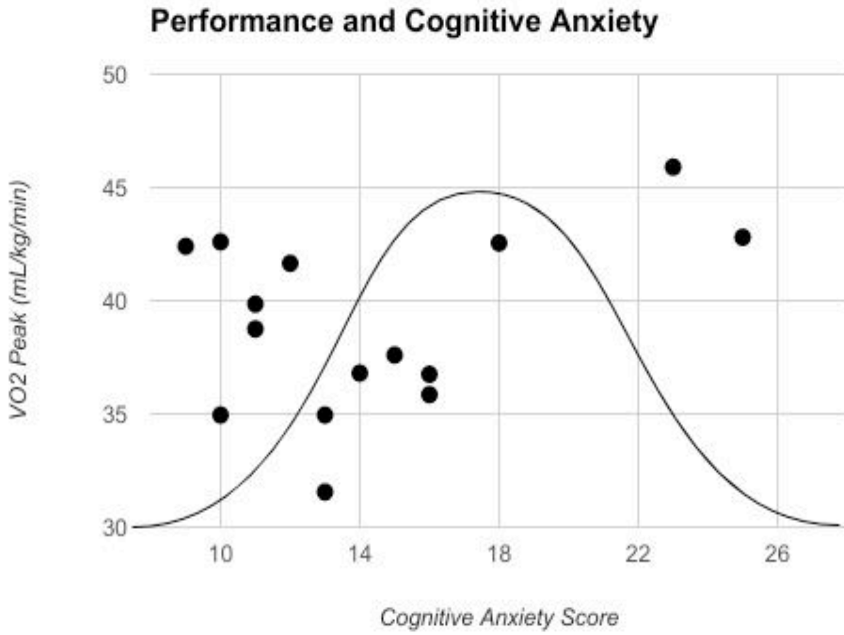

Figure 7. Displays the correlation between self-confidence and VO_2peak values. Both variables had a p-value of 0.240 and r^2 value of 0.045. An inverted-U shaped trend line was added to examine the relationship between variables.

DISCUSSION This study aimed to add to current knowledge regarding soccer positioning, training type, and pre-performance anxiety. Being an athlete requires both mental and physical preparation. Mental preparation and visualization techniques prior to competition have been used by sports psychologists to promote positive stimulation or visualization. Based on an R coefficient of +0.736, the study found a strong positive correlation between somatic and cognitive anxiety (Figure 4). A similar study found a noticeable correlation between cognitive and somatic anxiety (3). Based on current research, most findings on directional anxiety and athletic performance remain inconsistent (13, 17). Some research studies suggest that the three subcomponents (somatic, cognitive, and confidence) have separate relationships with performance and other studies have failed to find any relationship between anxiety subcomponents and performance (4,18).

Another key finding from this study is that there were no significant differences between training types, even with an overall increase in VO_2peak values from in-season training. This finding aligns with previous studies, which found sport specific training involving a ball to be more beneficial than aerobic and anaerobic training (1,12). Surprisingly, VO_2peak values were significantly lower in this study than in previously researched female collegiate soccer players. Differences observed may be connected to the variance in level of play within NCAA divisions (15). Overall, current research demonstrates that VO_2max values obtained with a cycle ergometer protocol are lower than those obtained with treadmill testing, which may account for the differences in this study (22).

The lack of significant differences across positioning, training type, and pre-performance directional anxiety may be due to small sample size, as this study recognizes potential limitations for determining significance with all dependent variables of interest. Other limitations resulting in no significant differences across dependent variables could be due to uncontrolled outside variables. Caffeine, diet, time of day, and hydration were not controlled during the study, which could have altering effects during exercise. Adherence to off-season program was not monitored due to several participants' lack of proximity to the university during summer months. Playing time was also not tracked during the study and could potentially alter in-season results. Lastly, another acknowledged limitation to the study was the latent period before Trial 2. Trial 2 was not conducted until two weeks after soccer season concluded. Participants were asked to continue normal in-season training up until testing because two weeks without exercise has been shown to have altering effects on fitness level, but adherence rate was not monitored (8).

Future research could potentially look at VO_2peak throughout a season to determine if a team fitness program is leading to overtraining in athletes. Based on study observations, several participants with low BMI struggled to complete bike stages not due to fatigue, but likely because of muscular strength. Therefore, future studies could examine the relationship between VO_2peak and muscle strength. Recent studies demonstrate that power enhancement improved endurance by 5-15% (15,17). For future examination of anxiety, this study would recommend testing cortisol levels prior to maximal testing. A less invasive option would be to examine pre-performance anxiety stress response with heart rate variability. With a determined positive correlation between somatic and cognitive anxiety from this study, future research should examine how the variables interact in altering or facilitating performance.

In conclusion, based on the results of this study, VO_2peak values were not affected by positioning type in female collegiate soccer players. Off-season and in-season training had no significant differences; therefore, this study could not recommend a specific training type for enhanced performance. A positive relationship was determined between cognitive and somatic anxiety, however, high and low levels of anxiety in all three subcomponents did not affect VO_2 peak values. The results show anxiety had no directional factor in facilitating or debilitating performance based on VO_2 peak values. Overall, this study showed positioning, pre-performance anxiety, and training type have no effect on VO_2 peak. The only statistically significant finding from the study shows a strong positive correlation between cognitive and somatic anxiety subcomponents.

PRACTICAL APPLICATION VO_2 max is a common form of testing used to predict aerobic fitness. High school, college, amateur, and professional athletes often complete testing to determine endurance success. This form of testing can be beneficial in designing training protocols and injury prevention programs. Having knowledge of a team or individual aerobic fitness in a sport can help in determining necessary areas of focus or improvement. Based on this study, without significant differences in VO_2peak values between training types, soccer teams could utilize one or a mixture of training types to enhance performance. VO_2peak values did not predict positioning, therefore, this study recommends a combination of team training and position specific training. With a positive interaction between cognitive and somatic anxiety, competitive athletes that struggle with competitive sport anxiety should use mental skills training tasks to help lower cognitive anxiety and cope with competition pressures from somatic anxiety. Having athletic teams take anxiety questionnaires, such as the CSAI-2, could help athletes understand their anxiety and if needed, find resolutions to solve high-moderate anxiety levels. Therefore, incorporation of mental fitness activities in teams and/or with individual athletes could be beneficial for increased performance success.

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References

1. Bassett, D.R., and Howley, E.T. (1999). Limiting factors for maximum oxygen uptake and determinants of endurance performance. Medicine and Science in Sports and Exercise. 32(1): 70-84.
2. Bloomfield, J., Polman, R., & O'Donoghue, P. (2007). Physical demands of different positions in FA Premier League soccer. Journal of Sports Science and Medicine, 6(1), 63-70.
3. Bridges, A., & Knight, B. (2005). The role of cognitive and somatic anxiety in athletic performance. Independent study. Hanover: Hanover College.
4. Craft, L. L., Magyar, T. M., Becker, B. J., & Feltz, D. L. (2003). The relationship between the Competitive State Anxiety Inventory-2 and sport performance: A meta-analysis. *Journal of sport and exercise psychology*, *25*(1), 44-65
5. Ekblom, B. (1986). Applied physiology of soccer. Sports medicine, 3(1), 50-60.
6. Fairclough, S. H., Tattersall, A. J., & Houston, K. (2006). Anxiety and performance in the British driving test. Transportation Research Part F:Traffic Psychology and Behaviour, 9(1), 43-52.
7. Ferguson-Stegall Lisa et al. *"Aerobic exercise training adaptations are increased by postexercise carbohydrate-protein supplementation." J Nutr Metab* 2011.
8. Gilmore, Jack. "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness, and Flexibility in Healthy Adults" *American College of Sports Medicine. 30:975–991, 1998*
9. Haugen, Thomas A., et al. "The role and development of sprinting speed in soccer." *International journal of sports physiology and performance* 9.3 (2014): 432-441.
10. Heyward V.H. (2006). Advanced Fitness Assessment and Exercise Prescription. Burgess Publishing.
11. Hill, A. V., & Lupton, H. (1923). Muscular exercise, lactic acid, and the supply and utilization of oxygen. QjM, (62), 135-171.
12. Hoff, J., Wisløff, U., Engen, L. C., Kemi, O. J., & Helgerud, J. (2002). Soccer specific aerobic endurance training. *British journal of sports medicine*, *36*(3), 218-221.
13. Jones, G., & Hanton, S. (2001). Pre-competitive feeling states and directional anxiety interpretations. Journal of sports sciences, 19(6), 385-395.
14. Little, Thomas, and Alun G. Williams. "Suitability of soccer training drills for endurance training." *The Journal of Strength & Conditioning Research* 20.2 (2006): 316-319.
15. Mohr, M, et al. Comparison between two types of anaerobic speed endurance training in competitive soccer players. *Journal of Human Kinetics*. 2016;51:183-192.
16. Martens, R. et al., (1990) Development and validation of the Competitive State Anxiety Inventory-2. Competitive anxiety in sport. Champaign, IL:Human Kinetics.
17. Neil, R., D. Mellalieu, S., & Hanton, S. (2006). Psychological Skills Usage and the Competitive Anxiety Response as a Function of Skill Level in Rugby Union. *Journal of Sports Science & Medicine*, *5*(3), 415–423.
18. Orbach, Iris, S. Price, and R. N. Singer. *The relationship between self-confidence and competitive anxiety in influencing sport performance*. Diss. University of Florida, 1998.
19. Stolen, Thomas et al. (2005) Physiology of Soccer. *Sports Medicine: Review Article*, 532-536.
20. Thierry-Aguilera, R. (2000). The Effect of Training in the Maximum Oxygen Consumption (VO Max) and the Physical Conditioning of College Female Soccer Players (Division I of the NCAA, USA).
21. Vanhoy, R. A. (2012). A comparison of two different treadmill protocols in measuring maximal oxygen consumption in highly trained distance runners (Doctoral dissertation).