

Off-Season Training and Psychological Variables as Predictors of Injury in High School Soccer Players

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Background & Significance



- **The youth sport explosion**
 - 35 million kids participating annually in youth sport programs (DiFiori, 1999)
 - 900% increase in female soccer participation alone (NFHS, 2004).
 - Soccer players are known to suffer more injuries in comparison to other sports (e.g., Inklarr, 1996; Junge, 2002).
 - Increased participation has increased the number of sport related injuries in adolescents- over 4 million injuries occur yearly (Bijur et al., 1995; Burt & Overpeck, 2001)

Physiological Considerations

- Injuries due to trauma, foul play by others, **lack of fitness and overtraining syndrome**, leading to **overuse injuries** (Fry, 1994; Kentta & Hassmen, 1998)



- Strength training has been shown to...
 - **Increase fitness** and help players withstand trauma (Junge, 2002; Williams, 1988).
 - **Increase bone mineral density** (decreased # of fractures) -- not seen with aerobic training alone (Block, 1980; Winett, 2001).



Psychosocial Variables: Stress

- **Holmes(1969):** Stressful life events & injury in football players
 - High-stress group had significantly more injuries
- Researchers have continued to focus on this relationship between stress and injury, though there have often been inconsistent findings.
- **Andersen & Williams (1988)** developed a model to account for the many factors that might influence this relationship.
 - These include:
 - history of stressors
 - Personality
 - coping resources



Recent Research

➤ Rogers & Landers (2005)

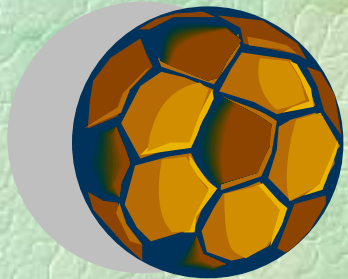
- High school varsity soccer players in Arizona
- Looked at peripheral narrowing due to stress, in response to the stress/injury relationship
- Peripheral Narrowing may result, but there are many other types of soccer injuries; not all occur from the side or behind
- Injury Severity & Injury Frequency were not considered, only the occurrence of injury
- Did not take into account players who pushed through injuries to keep playing, which often occurs in high level athletics



Combining the Psychological and Physiological Approaches



- **Strength training** (Williams, 1998) and **stress** (Rogers & Landers, 2005) have both been shown to affect injury rates
 - No study has looked at strength training as a possible “intervention” in the stress-injury relationship.
- The purpose of this study was to examine the impact of off-season training, life stress, coping ability, and personality (i.e., hardiness, trait anxiety) on injury in high school soccer players.
 - This study also expanded on recent research by considering the relationships between these variables and injury frequency & severity.



Methods

- Subjects consisted of 28 male & 97 female varsity soccer players from New Jersey High Schools during the fall of 2005.
 - **Age:** 15.6 ± 1.08 yrs
 - **Weight:** 59.12 ± 9.77 kg
 - **Height:** 166 ± 8.6 cm
- Athletes completed a number of questionnaires during preseason to measure variables which may have an impact on injury rates

Measures

- **Life Stress-** Survey for Collegiate Athletes (LESCA)
 - Designed for collegiate athletes, but still pertains to young athletes (Petrie, 1992)
- **Hardiness-** The Cognitive Hardiness Inventory (CHI; Nowack, 1990)
 - Assesses athlete's control, involvement, commitment, and challenge; Conveyed in terms of school, home-life, and soccer
- **Trait Anxiety-** State Trait Anxiety Inventory (STAI; Spielburger, Gorsuch & Lushene, 1970); 20-item measure
- **Coping Skills-** Athletic Coping Skills Inventory (ACSI 28; Smith et al., 1995)
 - Areas assessed included adversity, goal setting/ mental preparation, concentration, confidence, and coachability
- **Physical Fitness-** Inventory to assess physical activity prior to preseason
 - Frequency, duration, and intensity of Anaerobic activity
 - Frequency, and intensity of Aerobic activity

Injury Assessment

- Injury data was collected over the duration of the season by coaches with daily attendance:
 - Included limitations to play and practices missed due to injury and non-injury reasons (specifying types of injury as well)
- Players were interviewed by the researcher every 2 weeks to identify any nagging injuries unknown to coaches
- Injury was assessed using a modified Colorado Injury Reporting System (Blackwell & McCullagh, 1990)
 - Injuries were classified as **none**, **minor** (modification, but no missed practice), **moderate** (missed 1-7 days practice), and **severe** (missed more than 1 week of practice)
 - Days missed due to illness or other reasons were not counted as an injury

Statistical Analysis



➤ Logistic Regression

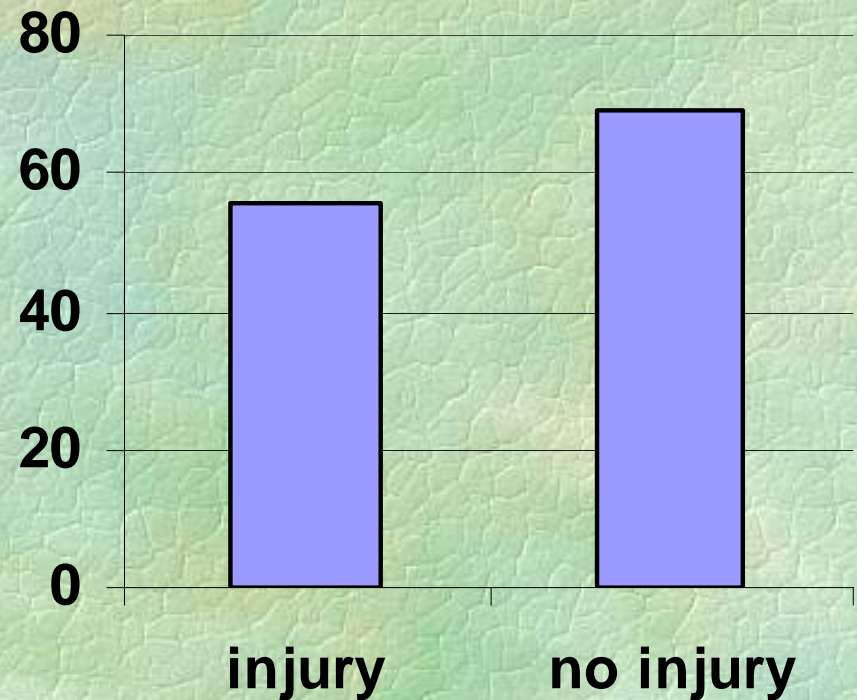
- Dichotomous dependent variables (Injury vs. No Injury)
- Predicted likelihood of an athlete to be injured, success depended upon accuracy of prediction
- Provides the odds ratio; the odds of being injured vs. non-injured

➤ Spearman's Correlation (r_s) was computed to determine:

- If a relationship existed between **WT & injury severity or injury frequency**
- If **psychological variables** were correlated with **injury severity or frequency**
 - Significantly correlated ($p < .05$) variables followed up using Kruskal-Wallis Test to examine if a difference existed between levels of injury severity or frequency
 - Followed up with a Mann-Whitney U Test to compare levels

Results– Frequencies

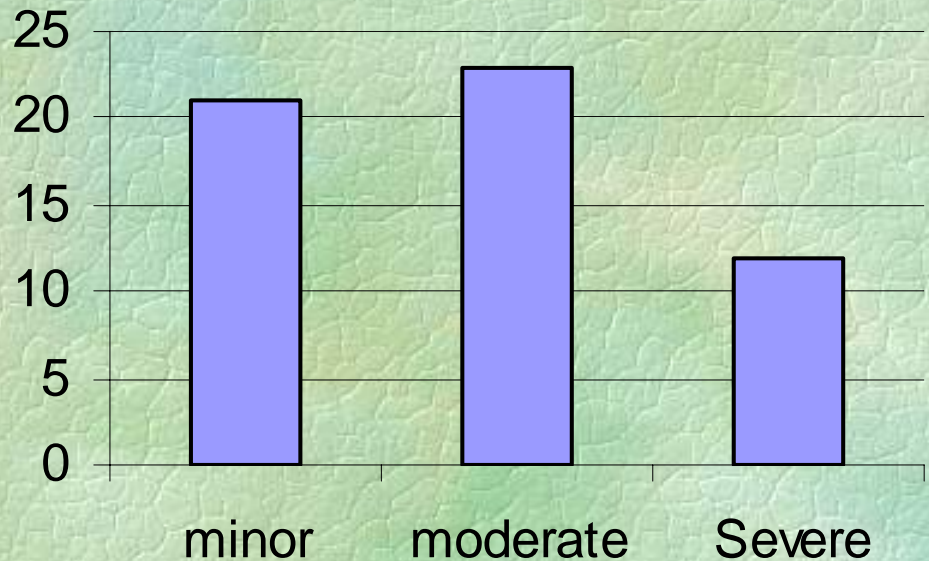
- Out of the 125 subjects:
 - only 46 weight trained (39%)
 - only 20 (16%) of those trained 3+ days/wk (min. for strength gains)
- 94% (118) of the subjects trained **Aerobically**
 - 82% 3+ days/wk
- 44.8% (n=56) of the subjects were **injured** during the season
 - 69 were **Not injured** at all during the season



Results- Injury Statistics

- Of the 56 injured subjects:
 - **44 were injured once**
 - **12 were injured 2+ times**

- Of the 56 injured subjects:
 - 21 had a **minor injury**
 - 22 had a **moderate injury**
 - 16 incurred a **severe injury**



Logistic Regression

- Weight training, WT frequency & WT Intensity were not found to predict injury ($p > .85$, $p > .50$, & $p > .60$, respectively)
- Though not found to predict injury, the low numbers of individuals who weight trained in preparation for the season may have affected results
- Total Life Stress was not found to be a predictor of injury occurrence ($p > .10$)

Logistic Regression Cont.

- **Trait Anxiety- found to predict injury** (a 1 unit increase in TA increased subjects chance of injury by >50%) ($\beta=.067$, $OR=1.07$, $p<.01$)
 - TA correctly classified 65.6% of the subjects
- **Hardiness- found to predict injury** (decreased hardiness increased chance of being injured) ($\beta = -.052$, $OR=.950$, $p< .01$)
 - Correctly predicted 67.2% of the cases as injured or non-injured
- **Coping- approached significance** as a predictor of injury occurrence ($p=.068$, $\beta =-.04$, $OR=.96$)
 - Correctly predicted 61.6% of the cases
 - Lower coping skills increased the chance of an athlete being in the injured group

Severity & Frequency Correlations

- **Weight Training** was not significantly correlated with either injury severity or injury frequency ($p > .50$)
- **Life Events Stress** was not significantly correlated to injury severity ($p > .13$), but approached significance for injury frequency ($p < .06$ and $r_s = .17$)
- **Hardiness** was significantly correlated with both injury severity ($r_s = -.31$, $p < .001$) and injury frequency ($r_s = -.32$, $p < .001$)
- **Trait Anxiety** was significantly correlated with both injury severity ($r_s = .30$, $p = .001$) and injury frequency ($r_s = .30$, $p = .001$)
- **Coping Skills** were significantly correlated with both injury severity ($r_s = -.18$, $p < .05$) and injury frequency ($r_s = -.18$, $p < .05$)

Severity & Frequency Follow-Ups

- Differences between levels of injury severity using the **Kruskal-Wallis**:
 - **Hardiness**, $\chi^2(3, N=125)=11.75, p<.01$
 - **Trait Anxiety**, $\chi^2(3, N=125)=12.44, p<.01$
 - **Coping Skills** - a difference was not found ($p>.18$)
- Follow-up **Mann-Whitney U** performed for **Hardiness** and **Trait Anxiety** found:
 - Significantly **higher Hardiness** in **non-injured** group than the **moderate injury** group ($p<.01$) as well as for non-injured group as compared to the **severe injury** group ($p<.05$)
 - Significantly **lower Trait Anxiety** in **non-injured** group than the **moderate injury** group ($p<.05$) as well as the non-injured group as compared to **severe injury** group ($p=.001$)
 - No relationship was seen between the minor and moderate injury groups or between the no injury and minor injury groups

Discussion

- Surprised by lack of strength training
 - Strength training has been shown to influence injury rates (Williams, 2000)
- Early research limited to specific psychosocial variables
 - Rogers & Landers (2005) showed a relationship existed with injury occurrence and many psychosocial variables
 - We examined relationship with **injury occurrence** as well as **Injury Severity**
- Those who sustained moderate & severe injuries were:
 - Significantly less **hardy**
 - Significantly higher in **trait anxiety**
 - Additionally, **coping skills** were correlated with severity

Advice for Coaches & Trainers

- Studies have found a **curvilinear relationship** with training and injury (Lee et al., 2001)
 - Suggests moderate strength training would be optimal for injury prevention
 - Lack of strength training may have prevented finding a correlation with injury occurrence – there was no “high” level to examine!
- Remarkable lack of participation in WT, considering the amount of research showing benefits – for both injury AND performance!
- Focus needs to be put on trying to reduce stress & trait anxiety; as well as to increase hardiness and coping skills in young athletes
 - In order to further reduce injuries, programs need to be implemented
- Coaches should recognize the need as well as suggest changes be made to summer work-outs for improving fitness