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

Nora Crawford
& Shawn M. Arent, PhD, CSCS

RUTGERS
UNIVERSITY

YOUTH SPORTS RESEARCH COUNCIL

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

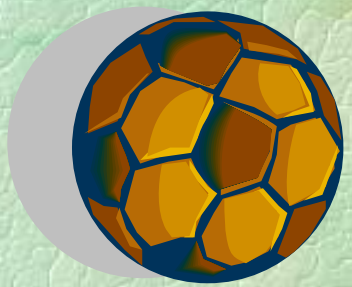
- Holmes(1969): Stressful life events & injury in football players
  - High-stress group had significantly more injuries
- Researchers have continued to focus on this relationship between stress and injury, though there have often been inconsistent findings.
- Andersen & Williams (1988) developed a model 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 ± 1.08yrs
  - Weight: 59.12 ± 9.77kg
  - Height: 166 ± 8.6cm
- 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

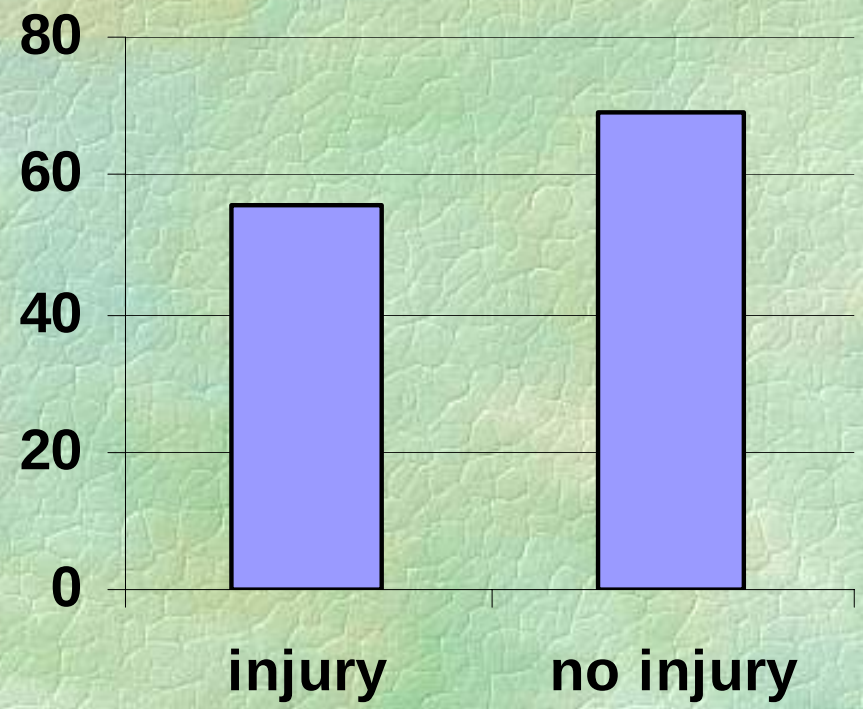
- Injury data was collected over the duration of the season by coaches with daily attendance:
  - Included limitations to play and practices missed due to injury and non-injury reasons (specifying types of injury as well)
- Players were interviewed by the researcher every 2 weeks to identify any nagging 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

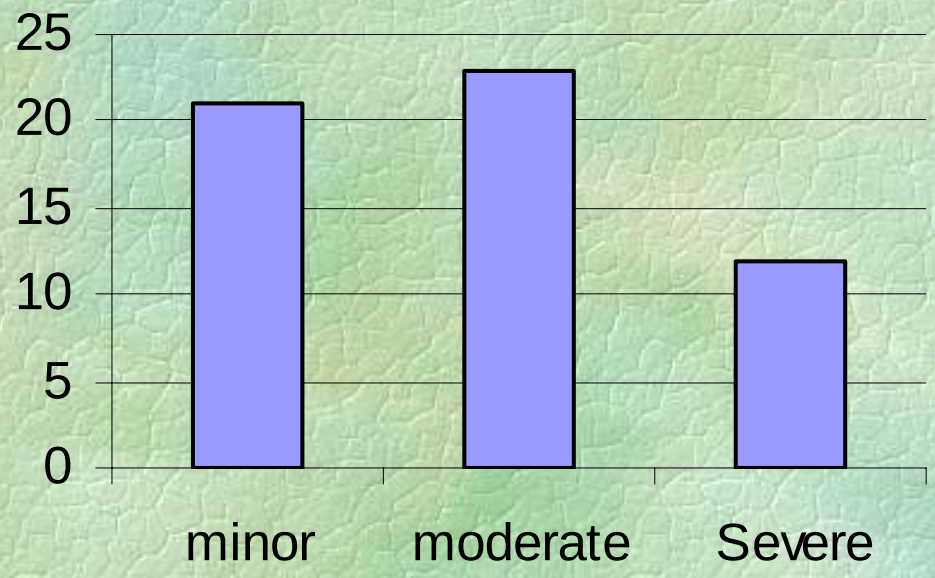
- Out of the 125 subjects:
  - only 46 weight trained (39%)
    - only 20 (16%) of those trained 3+ days/wk (min. for strength gains)
- 94% (118) of the subjects trained Aerobically
  - 82% 3+ days/wk
- 44.8% (n=56) of the subjects were injured during the season
  - 69 were Not injured at all during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