The Healthy Runner Study: Prevention of Bone Stress Injuries Through Nutritional Intervention in Collegiate Distance Runners

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PRESENTATION AGENDA

The Healthy Runner Project: Prevention of Bone Stress Injuries Through Nutritional Intervention in Collegiate Distance Runners

• PIs, Collaborators & Acknowledgments
• Project Goals
• Potential Benefits to Student-Athletes
• Potential Benefits to Conference; possible adoption Conference wide
• Project Methods
• Significant Results to Date
• Discussion
• Conclusion
• Next Steps
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PIs, COLLABORATORS, ACKNOWLEDGMENTS
- Michael Fredericson, MD Stanford University
- Aurelia Nattiv, MD UCLA
- Multidisciplinary team approach: dietitians, statisticians, athletic trainers

PROJECT GOALS
- Reduce the incidence and severity of bone stress injuries
- Reduce return to running time following bone stress injury
- Improve overall bone and reproductive health of female athletes using a nutrition education and screening program
- Optimize bone building nutrients

POTENTIAL BENEFITS TO STUDENT-ATHLETES AND THE PAC-12 CONFERENCE
- Optimize bone building nutrients and energy availability in female athletes
- Encourage PAC-12 programs to use Female Athlete Triad risk screening
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METHODS

- Yearly Assessments

- **Risk Factor Questionnaire**
  - Questions on general health, risk factors for fracture and osteoporosis

- **Nutrition Assessment**
  - Energy availability through dietary recall
  - Fat free mass calculation

- **Run Fueled App**
  - Web-based Nutrition Screening survey

- **DXA Scan**
  - Bone density assessment from the lumbar spine, distal femur, distal radius, and total body.

- **Lab Evaluation**
  - Leptin, ghrelin, N-telopeptide, P1NP, Vit D 25-OH, Free T3 and Total T3
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**METHODS**

- Female Athlete Triad Risk Assessment Tool: Low Risk (0-2 pts), Moderate Risk (3-6 pts), High Risk (6+). Determined following fall entrance physicals

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Low Risk = 0 points each</th>
<th>Moderate Risk = 1 point each</th>
<th>High Risk = 2 points each</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low EA with or without DE/ED</td>
<td>□ No dietary restriction</td>
<td>□ Some dietary restriction‡; current/past history of DE;</td>
<td>□ Meets DSM-V criteria for ED*</td>
</tr>
<tr>
<td>Low BMI</td>
<td>□ BMI ≥ 18.5 or ≥ 90% EW** or weight stable</td>
<td>□ BMI 17.5 &lt; 18.5 or &lt; 90% EW or 5 to &lt; 10% weight loss/month</td>
<td>□ BMI ≤ 17.5 or &lt; 85% EW or ≥ 10% weight loss/month</td>
</tr>
<tr>
<td>Delayed Menarche</td>
<td>□ Menarche &lt; 15 years</td>
<td>□ Menarche 15 to &lt; 16 years</td>
<td>□ Menarche ≥ 16 years</td>
</tr>
<tr>
<td>Oligomenorrhea and/or Amenorrhea</td>
<td>□ &gt; 9 menses in 12 months*</td>
<td>□ 6-9 menses in 12 months*</td>
<td>□ &lt; 6 menses in 12 months*</td>
</tr>
<tr>
<td>Low BMD</td>
<td>□ Z-score ≥ -1.0</td>
<td>□ Z-score -1.0*** &lt; - 2.0</td>
<td>□ Z-score ≤ -2.0</td>
</tr>
<tr>
<td>Stress Reaction/Fracture</td>
<td>□ None</td>
<td>□ 1</td>
<td>□ ≥ 2; ≥ 1 high risk or of trabecular bone sites†</td>
</tr>
<tr>
<td>Cumulative Risk (total each column, then add for total score)</td>
<td>____ points +</td>
<td>____ points +</td>
<td>____ points = ____ Total Score</td>
</tr>
</tbody>
</table>

*≥ 10% weight loss/month

‡ + other factors that indicate disordered eating

**ED**: Eating Disorder

**EW**: Estimated Weight
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METHODS

• Nutrition Assessment
  - Web-based nutrition screening survey
  - One-on-one meetings with sports dietitians
  - Evaluates current intake, risk for low energy availability, and other nutritional deficits

• Nutrition Goal Setting--Example goals:
  - Add one or more snacks
  - Increase energy density of current snacks and meals
  - Increase intake of nutrient dense carbohydrate foods
  - Increase intake of bone building nutrients
  - Add or modify pre- or post-workout snacks
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METHODS

- Vitamin D optimization through standardized supplementation model
  - Implemented 2017-2018 school year
  - Standardizes recommended supplement dose across multiple providers
  - Reinforces documentation of supplement dose in electronic medical record

<table>
<thead>
<tr>
<th>Serum Level Vitamin D</th>
<th>Vitamin D Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 50</td>
<td>Current supplement + 1,000 IU daily</td>
</tr>
<tr>
<td>40-50</td>
<td>Current supplement + 2,000 IU daily</td>
</tr>
<tr>
<td>30-40</td>
<td>Current supplement + 4,000 IU daily</td>
</tr>
<tr>
<td>20-30</td>
<td>Current supplement + 5,000 IU daily</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>50,000 IU weekly</td>
</tr>
</tbody>
</table>
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METHODS

• **Nutrition Intervention**
  - Includes goal-specific counseling sessions with sports dietitian
  - Run Fueled Phone App
    - Eight-week nutrition education curriculum
    - Two four-week modules providing handouts, video clips & educational slides
    - Provides recipes of the week
  - Aim to keep athletes above threshold of 45 kcal/kg fat free mass/day and achieve positive energy balance by increasing energy intake, reducing exercise energy expenditure, or both
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SIGNIFICANT RESULTS TO DATE

• Athlete Participation
  • 101 middle and long-distance female athletes enrolled since start of study (Stanford = 43, UCLA = 58)
  • Completion from 2017-2018 school year
    • 100% response rate
    • 100% completion screening questionnaires
    • 93% completion lab draws
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SIGNIFICANT RESULTS TO DATE

- Female Athlete Triad Risk Assessment
  - The Female Athlete Triad Cumulative Risk Assessment (CRA) can prospectively predict bone stress injuries
  - CRA score predicted future bone stress injury, with each additional point increasing risk by 13% (p=0.027)
  - Best baseline predictors of bone stress injury were age of menarche (p = 0.043) and bone mineral density (p=0.03)
  - Best longitudinal predictors of bone stress injury were oligomenorrhea (p=0.068) and BMD (p=0.04)
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SIGNIFICANT RESULTS TO DATE

- **Vitamin D**
  - In comparison to historical control group, results showed that serum Vitamin D levels were inversely related to time lost due to bone stress injury
  - 10-unit increase in serum Vitamin D associated with 17% decrease in days lost due to bone stress injury
SIGNIFICANT RESULTS TO DATE

- Bone Stress Injury Incidence
  - Currently analyzing bone stress injury severity and return to running data
  - Based on clinical trends we predict a decrease in BSI severity and decrease in time to return to weight bearing running

Stanford Raw Data:
2014-2015: 13 BSIs across 9 female athletes. (16 female athletes enrolled.)
2015-2016: 10 BSIs across 10 female athletes. (19 female athletes enrolled.)
2016-2017: 9 BSIs across 6 female athletes. (16 female athletes enrolled.)
2017-2018: 3 BSIs across 3 female athletes. (16 female athletes enrolled.)
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DISCUSSION
- Strengths of study: consistent bone stress injury assessment across institutions, consistent supplementation and nutrition interventions, near 100% athlete participation
- Potential limitations: can’t account for changes in training variables, recruiting

CONCLUSION
- Starting year three of our three-year prospective study
- Female Athlete Triad Cumulative Risk Assessment (CRA) can prospectively predict bone stress injury
- Vitamin D levels clinically defined as "sufficient" might not fully optimize bone health in female athletes

NEXT STEPS
- Full analysis of data for primary outcomes will be completed at the conclusion of the study
QUESTIONS?

THANK YOU!