“Physical and Physiological Characteristics, Health Issues and Common Injuries of the Female Soccer Player”

Vanessa Martínez Lagunas, M.A., CSCS

2008 NSCAA Annual Convention
January 17th, 2008

Vanessa Martinez

- Representative of the Latin American Women’s Subcommittee of LASCC
- Sports Science/Exercise Physiology PhD Student, University of Leipzig, Germany
- USSF “A” License/NSCAA Premier Diploma Coach
- DFB/UEFA “B” License Coach (Germany)
- Current player of the Bayern Munich Women’s Soccer Team
- Former player of the Mexican Women’s Soccer National Team (1999-2004) and the University of Texas at Austin (UT) Women’s Soccer Team (2002-2004)

Rapid Growth of Women’s Soccer

It is growing! 26 million women in the world play football ... that’s 10% of all football players worldwide
Presentation Outline

I. Physical and Physiological Differences between Male and Female Soccer Players

II. Health Issues:
   A. The Female Athlete Triad
   B. Iron Deficiency and Anemia

III. Injury Differences between Male and Female Soccer Players

I. Physical and Physiological Differences

Physical
- Weight
- Height
- % Body fat
- Muscular mass
- Bone density
- Somatotype

Physiological
- Hormones
- Menstrual cycle
- Respiratory function
- Cardiac function
- Hemoglobin
- Hematocrit

Physical Capacities
- Aerobic capacity (VO₂max)
- Strength
- Power
- Velocity
- Flexibility
Body Composition of the Reference Man and Woman

<table>
<thead>
<tr>
<th>Component</th>
<th>Man</th>
<th>Woman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remaining</td>
<td>15%</td>
<td>25%</td>
</tr>
<tr>
<td>Musclle</td>
<td>45%</td>
<td>36%</td>
</tr>
<tr>
<td>Bone</td>
<td>15%</td>
<td>12%</td>
</tr>
<tr>
<td>Fat</td>
<td>25%</td>
<td>15%</td>
</tr>
</tbody>
</table>

Sady y Freedson, 1984

<table>
<thead>
<tr>
<th>Physical Characteristics</th>
<th>Elite Male Soccer Players</th>
<th>Elite Female Soccer Players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>60-80 kg</td>
<td>50-70 kg</td>
</tr>
<tr>
<td>Height</td>
<td>170-180 cm</td>
<td>155-175 cm</td>
</tr>
<tr>
<td>% Body fat</td>
<td>6-16%</td>
<td>16.25%</td>
</tr>
<tr>
<td>Aerobic capacity (VO2max)</td>
<td>50.69 ml/kg/min</td>
<td>43.58 ml/kg/min</td>
</tr>
<tr>
<td>Power (vertical jump height)</td>
<td>40-61 cm</td>
<td>35-45 cm</td>
</tr>
<tr>
<td>Velocity</td>
<td>7.76-9.84 m/s</td>
<td>5.97-7.21 m/s</td>
</tr>
<tr>
<td>Flexibility (&quot;sit and reach test&quot;)</td>
<td>-4 to +24 cm (mean = 7.4 cm)</td>
<td>-6 to +28.5 cm (mean = 15 cm)</td>
</tr>
</tbody>
</table>
Physical Profile

<table>
<thead>
<tr>
<th>Category</th>
<th>Women’s Soccer</th>
<th>Men’s Soccer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total distance covered</td>
<td>9.7-11.3 km</td>
<td>10-13 km</td>
</tr>
<tr>
<td>High speed running</td>
<td>0.71-1.70 km</td>
<td>1.90-2.43 km</td>
</tr>
<tr>
<td>Average relative intensity</td>
<td>70-85% VO2max</td>
<td>75-80% VO2max</td>
</tr>
<tr>
<td>Change of speed direction or activity</td>
<td>every 4-6 sec</td>
<td>every 4-6 sec</td>
</tr>
<tr>
<td>Total energy cost per game</td>
<td>~1,100 kcal for a 60 kg woman</td>
<td>~1,500 kcal for a 75 kg man</td>
</tr>
</tbody>
</table>

II. Health Issues

A. The Female Athlete Triad

**Definition**

- Disorder eating
- Menstrual dysfunction
- Osteoporosis

Higher incidence in sports that emphasize beauty and thinness but also common in team sports, such as soccer.
Disorder Eating

*Prevalence:* 1 - 62% in female athletes and ~32% in female soccer players

<table>
<thead>
<tr>
<th>Anorexia</th>
<th>Bulimia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of fat and muscle mass</td>
<td>Erosion of tooth enamel</td>
</tr>
<tr>
<td>Dry skin and hair</td>
<td>Diarrhea or constipation</td>
</tr>
<tr>
<td>Cold intolerance</td>
<td>Abdominal and chest pain</td>
</tr>
<tr>
<td>Loss of menstruation</td>
<td>Sore throat</td>
</tr>
<tr>
<td>Lanugo on face and trunk</td>
<td>Menstrual irregularities</td>
</tr>
<tr>
<td>Loss of concentration</td>
<td>Hemorrhages</td>
</tr>
<tr>
<td>Low pulse and blood pressure</td>
<td>Callus</td>
</tr>
</tbody>
</table>

Menstrual Dysfunction

*Prevalence:* 6 - 79% in female athletes

**Types**
- **Delayed “Menarque”**
  - Appearance of 1st menstruation after 16 years of age
- **Irregular periods or oligomenorrhea**
  - 4 to 9 menstrual periods per year
- **Amenorrhea**
  - Complete disappearance of menstruation or < 3 periods per year

**Possible Causes**
- Hormonal irregularities
- Long-term training of high intensity
- Calorie deficits
- Emotional stress

Osteoporosis

- Early decrease of bone density
- Results in increased bone structure deterioration and fragility, and thus, increased risk of stress fractures

*(Nieman, 2003)*
Diagnosis of Osteoporosis

- DEXA: Dual Energy X-ray Absorptiometry:
  - Measures density (T-value) of thigh bone or spine
  - The T-value then is compared to the average bone density of women your age
- T-value: ACSM classifications:
  - >1: "normal bone density"
  - between -1.0 and -2.5: "low bone mineral density"
  - ≤ -2.5: "osteoporosis"

Osteoporosis Risk Factors

- Heredity (explains 60-80% variation)
- Age
- Sex
- Smoking
- Alcohol intake
- Medications
- Hormones (estrogen)
- Lack of weight-bearing physical activity
- Nutrition
Consequences of the Triad

- Malnutrition
- Rapid body weight loss
- Compromised reproductive, immune and cardiovascular function
- Irreversible bone damage
- Impaired sports performance and adaptation to training
- Delayed recovery after exercise
- Increased risk of injury
- If not identified early and treated properly the triad can cause death

Treatment of the Triad

- Reduction of training intensity (~10-20%)
- Increase caloric intake by 10-20% in order to increase body weight by 2-3%
- Ingest a calcium dietary supplement (1,500 mg/day) and vitamin D
- Immediately refer affected athletes to the adequate health professionals (i.e. gynecologists, psychologists, nutritionists)

Prevention

- Physical and medical evaluations during preseason
  - Energy and nutrient intake, possible ED behavior, menstrual status and history, changes in weight and body composition, stress fractures, cardiac arrhythmias, and depression.
- Encourage adequate nutrient and caloric intake
- Use periodization of training
- Avoid that athletes try to lose weight during the competitive season
B. Iron Deficiency and Anemia

- Iron: key component of hemoglobin
- Low levels of hemoglobin may lead to reduced exercise performance and fatigue
- Female have higher iron requirements than men
- High prevalence of iron deficiency in female athletes
  - Soccer: Players of Swedish National Team
    - 59% had iron deficiency
    - ~1 in 3 experienced anemia

Iron Deficiency and Anemia

**Causes**
- Poor absorption of iron by the body
- Inadequate daily intake of iron (vegetarians higher risk)
- Pregnancy
- Growth
- Blood loss due to heavy period or internal bleeding

**Symptoms**
- Cold intolerance, pale skin color, fatigue, irritability, dizziness, weakness, shortness of breath, sore tongue, brittle nails, decreased appetite (especially in children), and headache

Iron Deficiency and Anemia

**Diagnosis tests**
- Red blood cell measures of hemocrit and hemoglobin
- Size and number of red blood cells
- Serum iron level
- Iron binding capacity in the blood
Iron Deficiency and Anemia

**Prevention**
- Eat iron-rich foods (red meat, liver, legumes, cereals, raisins, green leafy vegetables and egg yolks)
- Vitamin C aids in iron absorption

III. Injury Differences

Common sites and injury types in soccer
- Most common sites: ankles, knees, and head
- Common injury types:
  - Contusions y abrasions
  - Muscular strains (quadriceps, adductors, biceps femoral)
  - Ligament and tendon injuries
  - Fractures (particularly tibia and fibula)
  - Dislocations (particularly clavicle)
Injuries to Women at FIFA Tournaments

- 174 women’s matches from seven international tournaments
- 1999 and 2003 FIFA Women’s World Cups
- 2000 and 2004 Olympics

FIFA Results

- Total of injuries: 387
  - 2.2 injuries per match (for men, this is ~2.7 injuries per match)
  - The two Women’s World Cups had the lowest injury rate (1.5 injuries per match) and the youth championships the highest (2.7 injuries per match)
- Injury rates in games are significantly higher than in training

Major difference between the injury rates of male and female soccer players

- Female soccer players are 2 to 8 times more susceptible to suffer from knee and ACL injuries than their male counterparts (Silberberg, 2002)
Common symptoms of ACL tear

- Sudden given away of the knee
- Hearing a “pup” at the time of the injury
- Sudden swelling of the knee
- Pain on the knee when walking

ACL injury rate in collegiate soccer

(Arendt y Dick, 1996)
Possible causes of this higher rate of ACL injury among female players

**Internal Factors**
- Genetics
- Anatomical structure: size and strength of ligaments, hip-femur angle
- Joint laxity
- Muscular imbalances: quadriceps/hamstrings ratio
- Hormonal differences

**External Factors**
- Muscular strength, fitness, coordination, and balance
- Upright position: landing technique
- Playing experience
- Playing surface
- Environmental conditions

**Treatment**
- Surgery
- Physical Therapy
FIFA Medical Centers of Excellence

- **Europe**
  - Schulthess Clinic in Zurich, Switzerland (May 2005)
  - Orthocenter of the Technical University of Munich, Germany (early 2008)
- **America**
  - Santa Monica Orthopedic Sports Medical Group in California, USA (December 2007)
- **Asia**
  - St Marianna University School of Medicine in Kawasaki, Japan (December 2007)
- **Oceania**
  - Adidas Sports Medicine Center in Auckland, New Zealand (early 2008)
- **Africa**
  - Centre for Exercise Science and Sports Medicine at the University of Witwatersrand in Johannesburg, South Africa (early 2008)

---

**Prevention**

- Strengthening musculature and ligaments around the knee
  - PEP (Prevent Injury/Enhance Performance) Program
  - The FIFA 11 adapted for women (coming soon)
- Proper warm-up and cool-down before and after games and practices
- Avoid overtraining

---

**ACL Prevention: PEP Program**

http://www.aclprevent.com/pep_replacement.htm#map

Developed by the Santa Monica and Sports Medicine Group, CA lead by U.S. Soccer team physician Dr. Bert Mandelbaum
ACL Injury Prevention Programs Guidelines

- Promote a “ready position” with slightly bent knees and light feet
- Require one leg at a time
- Require changing direction
- Require acceleration and deceleration
- Involve shifting balance
- Encourage soft landings
**Take Home Messages**

- Select appropriate training loads for your female athletes based on their physical and physiological characteristics and use physical assessments to monitor training effectiveness.
- Screen players for the Female Athlete Triad (menstrual, diet, and exercise history).
- Never assume that menstrual irregularities of your players are a normal outcome of training.

**Take Home Messages**

- Avoid that players try to lose weight during the competitive season.
- If you identify an athlete that might be suffering from one or more elements of the Female Athlete Triad immediately refer her to the adequate health professionals.
- Women have a higher risk to suffer from ACL injuries. Therefore, coaches should consider using an ACL injury prevention program to help their players avoid this injury.

**Recommended Resources**

Questions for Discussion

1) Does menstruation impairs sports performance?
2) Does soccer have an impact on the ability to have children?
3) Can women play and train when they are pregnant?
My Email:

vane10fut@hotmail.com