How Should the Referee Prep for and Recover from a Match?

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What Makes a Referee Successful?

*Decisions, decisions, decisions...*
- Knowledge
- Experience
- Keeping up with the game
- Focus and concentration

*Today...*
- Match Demands
- Fitness
- Diet and Hydration
The Mental Game

**90 Minute Match**
- 137 observable decisions (>60% with asst)
- 65 non-observable decisions
- 3-4 per minute

*Greater decision rate at the end of each period and during added time*
The Demands of a Match

Distance Covered (miles)

- EPL
- County
- Danish Referees
- Serie A
- College
- High School

(80 min)

Midfield Players
Types of Movements

- Sprinting
- High Speed Running
- Running
- Jogging
- Walking

Distance Covered (m)

<table>
<thead>
<tr>
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<th>Distance Covered (m)</th>
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<tbody>
<tr>
<td>EPL</td>
<td>8000</td>
</tr>
<tr>
<td>Women</td>
<td>10000</td>
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<tr>
<td>Men</td>
<td>10000</td>
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Players

Referees
Additional Movements

Referees also...

- Cover up to...
  - 1000m running backwards
  - 200m running sideways

- Produce a high intensity bout...
  - Every 33.5 sec of play
  - That lasts ~2.5 sec

This increases energy cost by ~20%
The Physiology of Refereeing

**Cardiovascular**
- 85-90% of maximal HR
- More than half of the match is spent with a HR between 90-100% of maximal

**Fitness**
- 75-85% of VO$_2$max
- Typical VO$_2$max is 40-50 ml O$_2$/kg/min
  - Players ~ 60 ml O$_2$/kg/min
  - 2 miles in 12 minutes (Cooper Test)
Assistant Referees

**Total Distance:** 7,300 m (4.5 mi)
- Sprinting: 310 m
- High Speed Running: 300 m
- Moderate Speed Running: 500 m
- Sideways & Backwards: 1,220 m

**Avg Heart Rate**
- 137 bpm
  - 73% of maximal
  - 65% of VO$_2$max
Referee and Player Work Loads

Referees respond to the players

(Weotton et al., 2011)
Other Factors

Age – As we get older, we slow down

- Aging
- Experience

![Graph showing the relationship between age and high intensity running distance. The Pearson correlation coefficient is r = -0.527, p < 0.001, n = 69.](chart.png)
The Total Energy Cost of Refereeing

- Marathon: 2500 kcal
- Soccer: 1500 kcal
- Refereeing: 1000 kcal
- Tennis: 800 kcal
- Basketball: 500 kcal
- Ice Hockey: 500 kcal
- Cross Country: 500 kcal
- Wrestling: 200 kcal

0 500 1000 1500 2000 2500 3000

Total Energy Cost (kcal)
Importance of Fitness

Fitter referees cover more distance

Krstrup and Bangsbo, 2001
Effects of Training

*Training = More work, better positioning*

Krustrup and Bangsbo, 2001
Fitness and Fatigue

Fit referees...

- Exercise at a lower percentage of their maximal
- Spend less time standing
- Execute more sprints (especially at the end of each period)
- Are in an optimal position (right place at the right time)
- Show less mental fatigue
How Can Referees Prep and Recover?

**Referees**
- Run a lot and expend a lot of energy
- The intensity of activity can be high
- They can become dehydrated
- Have a very high “mental load”

**Factors contributing to referee performance**
- Mental – focus, concentration
- Physiological – fitness and physical performance

**Improving performance...**
- Training
- Diet **
What We Know About Diet and Performance

Refereeing requires a lot of energy (~1000 kcal)
Poor diet leads to glycogen depletion and hypoglycemia

![Graph showing muscle glycogen and blood glucose levels over match time with high and low CHO diets](image)
Dehydration

*Fluid replacement during the match is limited*

**Moderate Temperature** (68-72° F, 75% RH)
- 1.5 to 2.0 L of fluid lost
- ~2% of body weight

**Assistant referees**
- Fluid loss about half of center referees

*Performance is affected with 2% fluid loss*
Hypoglycemia and Dehydration

Effects on Performance
- Decreased “energy” and lethargy
- Reduced motivation
- Irritability
- Poor decision making
- Loss of motor skills - technical

Dehydration - danger signs
- Weight loss of more than 3%
- Heat exhaustion
- Heat stroke
- Death
Preparation - Before the Match

A Solid Diet

*Carbohydrates, Proteins*
- Pasta, rice, bread
- Fresh fruits and vegetables
- Lean meats
  - Chicken & turkey
- Low fat milk, fruit juices

*Weak - Avoid*
- Fried and fatty meats
- Pastries
- Canned fruits
- Soda
- Butter & Sauces
Preparation - Before the Match

**Pre-Match Meal**
- High in carbohydrates, low fat, some protein
- Fluids

**Pre-Match Snack**
- Carbohydrates – Chews
- Caffeine ??

**Hydration**
- Water
- Sports Drink

*Feel full but not bloated or sluggish*
During the Match

*Drink when you can*

*At halftime*
- Water or a sports drink
- Snack (easily digestible)

*Fluids and carbohydrates*

*More important with...*
- Heat and humidity
- Multiple matches
Half-Time Re-Warm Up?

**Start of the Second Period**
- More total and high speed running

**Why?**
- More rapid recovery
- Muscle temperature
- Blood glucose (energy)
 Recovery

The first 60 minutes

- **Carbohydrates** *(plus some protein)*
  - 1.0-1.5 g/kg
  - 85kg (185 lb) → 85-125 g CHO
  - 2-10 g Protein

- **Fluids**
  - 20-30 oz (600ml – 1L)
  - Water / Sports drinks

- **Low Fat**
Jump Start the Recovery Process

Muscle Glycogen

Match 1
↓

Match 2
↓

High CHO Recovery

Low CHO Recovery

Match
Recovery (45-60 min)
Recovery (24 hours)
Recovery
A long-term approach

- High Carbohydrate

- High Fat
Recovery
Hydration

**Replace 1.5x fluid lost**
- 1 kg lost = 1.5 liters
- 2 lb lost = 1.5 quarts

**Soon after the match**
- Sports Drinks - A good source of carbohydrates
- Avoid caffeine *(energy drinks)*
- Spread over the next 24 hrs

**Alcohol**
- Can delay recovery
- Can increase delayed-onset muscle soreness
Does this Work?

Does diet affect the match?

CHO or Placebo supplements given before each match

![Graph showing goals scored and goals allowed for CHO and Placebo over two periods.](image-url)
Diet and Performance

Does diet affect the match?

Teams placed on low and high CHO diets – cross over study

Aggregate Score:
Low CHO: 2
High CHO: 5
Special Case – The Diabetic Referee

Type 2 Diabetes

Refereeing can help with *glucose control* (training)

**Before the match**
- Monitor glucose
- Carbohydrates as needed
- Hydration

**During the match**
- Hypoglycemia
- Carbohydrates as needed

**After the match**
- Monitor glucose
- Carbohydrates as needed

Consult your physician / dietician
Special Case – The Overweight Referee

Extra Pounds / Overweight / Obese

Refereeing can help with *weight, blood pressure, cholesterol, etc* (fitness training)

**Before the match**
- Carbohydrates but limit
- Hydration

**During the match**
- Fluids
- Carbohydrates as needed

**After the match**
- Carbohydrates as needed
- Limit calories

**Everyday Diet**
- Reduce calories
- Limit fat intake
To Recap...

**Soccer refereeing**
- Requires prolonged and high intensity efforts
- Uses about 1000 kcal per match
- Causes noticeable fluid loss

**Both diet and fitness can affect physical and mental performance**

**Everyday and recovery diet should be...**
- High in carbohydrates
- Low in fat
- Contain plenty of fluids
For More Info...

**www.scienceofsocceronline.com**
- FaceBook
- Twitter

**Science Behind Soccer Nutrition**
- Amazon

**US Youth Soccer & NSCAA Websites**
- Nutrition articles
- This presentation