Extreme Conditioning Programs: Evaluating and Managing the Risk

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Def. 1: Going to great or exaggerated lengths
Def. 2: Exceeding the ordinary, usual, or expected
Definition of ECPs: Consortium for Health and Military Performance and American College of Sports Medicine Consensus Paper on Extreme Conditioning Programs in Military Personnel

Extreme conditioning programs (ECPs; e.g., CrossFit, Insanity, Gym Jones, and others) are characterized by high-volume, aggressive training workouts that use a variety of high-intensity exercises and often timed, maximal number of repetitions with short rest periods between sets.”

Though popular...

“...physicians and other primary care and rehabilitation providers have identified a potential emerging problem of disproportionate musculoskeletal injury risk, particularly for novice participants, associated with ECPs.”

Muscle strains, torn ligaments, stress fractures, Mild to severe cases of potentially life-threatening exertional rhabdomyolysis are reportedly occurring at increasing rates as the popularity of ECPs grows

The Concerns

Is the purported greater injury risk over traditional conditioning programs valid?

Are these programs measurably inconsistent with accepted industry standard guidelines for safe and appropriate exercise prescription and progression?

Would a functional conditioning advantage of ECPs mitigate an increased occupational and operational threat?
One ECP Responds:
*An Answer, J. A. Glassman, 2012*

J.A. Glassman, PhD, CrossFit Chief Scientist
Father of CrossFit founder, Greg Glassman
CrossFit Inc. established in 2000
Since 2003, blog of info and Workout of the Day (WOD) at crossfit.com
4,500 affiliated gyms
35,000 Level 1 trainers

The Aims of CrossFit:

to forge a *broad, general* and inclusive fitness.

to build a program that will best prepare trainees for *any physical contingency* — not only for the unknown, but for the unknowable.

“Our specialty is not specializing.”

Glassman’s Equation

Constantly Varied Functional Movement
@ High Intensity
+
Communal Environment
=
Health
One ECP Responds:  
*An Answer, J. Glassman, 2012*

Offense was taken  
92-page parsing of words and intent  
Key points:  
- CrossFit workouts are less extreme than those of ACSM-sanctioned military PT.  
- CrossFit workouts include individualizing through scaling or substitution of movements, as required, and always by prescribing an individual’s best effort.  
- CrossFit is not suited to the regimentation of group drills that lead to overexertion.

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One ECP Responds:  
*An Answer, J. Glassman, 2012, cont.*

“Exertional heat illnesses, including rhabdomyolysis, and participation in conditioning programs are gradually rising in response to war time risks, and not the troops’ vain demand for getting ripped.”

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One ECP Responds:  
*An Answer, J. Glassman, 2012, cont.*

“The claims of the Consensus Paper must be rejected because the CHAMP and ACSM authors rely on anecdotal reports of exertional rhabdomyolysis, providing no data on the increase in popularity of ECPs. Nor do they provide any data on actual ECP participation in the military, much less a causal analysis showing from data that any increase leads the reported illnesses and alleged injury rates, as causality requires.”
One ECP Responds:

Exhibit A

YOU ARE RESPONSIBLE FOR HEEDING YOUR OWN BODY’S LIMITATIONS. YOU ARE RESPONSIBLE FOR SETTING YOUR OWN LEVEL OF EXERTION. DO NOT EXCEED YOUR BODY’S LIMITATIONS. ONLY YOU KNOW WHAT THESE LIMITS ARE.

Consent and Release Form

Summary of ECP Popularity

Exponential explosion in the last 5-10 years

Commonalities

- Program design
  - Variety, intensity, work:rest ratios
  - High perceived exertion
- Brand design and marketing strategies
  - Population specific
  - Egocentric- plays on toughness
  - Promote loyalty and discipleship

Tremendous amount of anecdotal success stories
A Training Legacy

Popularity of running and bodybuilding greatly increased in the 1970s and defined the standards of popular fitness for the next 30 years.

Traditional methods v. ECPs

- Traditional military physical training
Traditional methods v. ECPs

Concerns for Extreme Conditioning

**CAUTION**

- Volume and intensity
- Functionality/modal domains
- Program planning/coaching

Acknowledged and addressed?

 crosses and skulls. 

CrossFit Induced Rhabdo

The Truth About Rhabdo

Rhabdomyolysis Revisited
Addressed for risk reduction or badge of honor?

“Countless badasses from sporting and special operations communities, long regarded as bulletproof, have been burned at the stake of ego and intensity. "As it turns out, the burning is rhabdo, and we now find ourselves obligated not just to explain CrossFit’s potency but to warn of its potential lethality.”
- CrossFit Journal Issue 38, Oct 2005

Cause and Effect

- Documented cases from many different forms of exercise and activity
  - Military trainee’s and active duty personnel
  - Marathoners
  - Middle school PE participants
  - Recreational exercisers
- NO DISTINCT CAUSE AND EFFECT RELATIONSHIP WITH ECP’s at this time
- Many other confounding factors

Functional Movement

- “Functional movements are universal motor recruitment patterns” - The CrossFit Training Guide
- “Include the same movement pattern and the same relative timing as the “goal movement” - Paul Chek
- “Involve three planes of motion and all joints” - Gary Gray and Vern Gambetta
- “Functional training is any form of training that improves any relevant biomotor ability that does not come at the detriment to other biomotor abilities”
- Dr. Mel Siff
Are they really "functional" exercises?

Or just a little exotic?

How dangerous are these "functional" exercises?

Especially when fatigued.
Effects of Fatigue on Form

Does performing technically complex lifts for high reps in a state of fatigue concern you?

Bad execution of exercise is everywhere

Is it functional to leave out the transverse and frontal planes?
Coaching is Imperative

Finding a balance between technique and intensity is one of the things that separates good trainers from great trainers, and it’s one of the keys to getting optimal results from the CrossFit program.

What makes a good coach?

• Properly educated and trained
  • Meet pre-requisite standards
    • 17 years of age to a college degree
    • Certified through a credible educational institute
  • Can we be sure of quality?
    • Training
    • Accreditation
• May be impossible to ensure quality.

Evaluating ECPs

Benefits

• Functionality of blending strength/endurance
  • Variety minimizes overuse injury and prepares for broad ranging physical requirement
  • Time Efficiency
  • Mental Toughness
  • Potential anabolic effect
  • Camaraderie
    • The Art of Suffering
    • Tapping into the Primal
Evaluating ECPs Benefits

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Mod-high volume & intensity with relatively short rest intervals is associated with increased Testosterone

Some ECPs associated with high cortisol levels, thus

Kraemer, J Strength Cond Res, 2012
Needs Analysis

• The first step in this process is to define your population's needs.
  • Remember that needs are different than desires!

What’s your function?

"Functional training is any form of training that improves any relevant biomotor ability that does not come at the detriment to other biomotor abilities"  
  ~Dr. Mel Siff

Dominant biomotor abilities

F= force or strength  
S= speed  
E= endurance

10 km runner

Strength

Power

Power-endurance

Muscle endurance

Endurance

Anerobic threshold

Aerobic threshold
SWAT
Muscle endurance
Power
Strength
Speed
Anabolic threshold
Aerobic threshold
Endurance

Soldier – U.S. Army
Power-endurance
Muscle endurance
Strength
Speed
Anabolic threshold
Aerobic threshold
Endurance

Long-term Development Model

If our young soldiers are not arriving with a movement skill set...

then we must train fundamentals well...

...in order to expect effective participation in ECPs.

Sample CrossFit On-Ramp Program

<table>
<thead>
<tr>
<th>Day</th>
<th>Skill exercise</th>
<th>New Skills</th>
<th>WOD (breakout of the day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1L / 2L (dynamic range of motion)</td>
<td>Squat, Run, Push-up</td>
<td>For Time: 200m Run, 15x Squat, Dumbbell thruster 220m Run</td>
</tr>
<tr>
<td>2</td>
<td>Squat</td>
<td>Dead Lift, Shoulder Press, Push Press, WOD</td>
<td>For Time: 10x (20m x 6) Slam &amp; Jump, 10x (20m x 6) Slam &amp; Jump</td>
</tr>
<tr>
<td>3</td>
<td>Dead Lift</td>
<td>Rover (SDHP), Thruster</td>
<td>Total Time (add M:SS): How many (SDHP) 30 Thrusters (40/15 for PVC) Time each round (one person rests while partner goes) 2 minutes rest (approx. 1 min rest)</td>
</tr>
<tr>
<td>4</td>
<td>Dead Lift</td>
<td>Kipping, Jumping Pull-ups, Walking Lunges</td>
<td>4 rounds for time: Run 200m, Large 30 ft, 20 jumping pull-ups</td>
</tr>
</tbody>
</table>

Physical Readiness

WORK CAPACITY

Aerobic and Anaerobic Endurance  Strength
Flexibility  Movement Efficiency  Body Composition

Climbing  Jumping & Vaulting  Individual Movement Tech
Lifting & Carrying  Survival Swimming  Foot Marching
Crawling  Running  Survival Swimming

TSAC CONFERENCE
TECHNICAL STRENGTH AND CONDITIONING

4/8/2013
Commitment to Fundamentals

- What will inevitably doom a physical training program and dilute a coach’s efficacy is a lack of commitment to fundamentals.
  - Greg Glassman, Founder of CrossFit
- “Programs that start with the specifics and ignore the basic core elements of strength and power limit optimal development over time and set the stage for injury.”
  - Wm Kraemer, Editor, J Strength Cond Res
- “Nobody wants to be a yellow belt anymore, it’s straight to the black belt.”
  - Frank Palkoska, Director, US Army Physical Readiness Division

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Training the Components of Fitness

- Working
  - \[ W = F \times D \]
  - \[ P = \frac{(F \times D)}{T} \]
- Training
  - Def: Preparation for a task

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Where does your trainee fit on this pyramid?

- Strength
- Power
- Power-endurance
- Speed
- Anerobic threshold
- Aerobic threshold
- Muscle endurance
- Endurance

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Aerobic v. Anaerobic

High-intensity interval training is a time-efficient strategy to increase skeletal muscle oxidative capacity and induce specific metabolic adaptations during exercise that are comparable to traditional endurance training."
—Burgomaster, J Physiol, 2008

<table>
<thead>
<tr>
<th>Variable</th>
<th>SIT Group (n = 10)</th>
<th>ET Group (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>30 x 6-4 repeats, 5 min rest</td>
<td>40-60 min cycling</td>
</tr>
<tr>
<td>Training intensity</td>
<td>All out maximal effort</td>
<td>65% of VO2max</td>
</tr>
<tr>
<td>Weekly training</td>
<td>~15 min</td>
<td>~6.5 h</td>
</tr>
<tr>
<td>Weekly training volume</td>
<td>~235 k</td>
<td>~235 k</td>
</tr>
</tbody>
</table>

Resistance Training

• Fundamental goal:
  • Improve maximal strength and power

  “It is upon these two fundamental pillars of neuromuscular fitness that one can then extend and expand physical capabilities to include local muscular endurance and task-specific performances.”
  • Kraemer, J Strength Cond Res, 2012

Strength Continuum

- Strength
- Hypertrophy
- Power
- Muscular Endurance

Repetition maximum continuum
Exercise Antagonism From Concurrent Strength/Endurance Training

Problem
- Dual demands of motor units
- Stimulation of catabolic signaling
- Oxidative signaling (AMPK)
- Volume of work
- Overreaching

Potential Solution
- Rest and recovery between training days
- Reduced volume of exercise
- Energy capability and pre-exercise diagnosis for capability
- Careful periodization of work totals from all sources
- Careful sequencing and reduction of aerobic stimulus

Kraemer, NSCA National Conference, 2012

Exercise Antagonism, cont.

Problem
- Too much high intensity volume and a lack of metabolic matching with sport demands
- Recovery and rest not valued enough in training programs!

Solutions
- Better needs analyses
- Better matching with sport demands
- Sport Practice Assessments
- Monitoring progression and capacities
- Quality over quantity!

Kraemer, NSCA National Conference, 2012
Specificity

- “Fit for what?”
- For soldiers, the answer is “Fit for current and potential training and combat missions.”
- Tactical PT
  - operationally relevant degree of intensity and volume
  - preceded by general fitness development (strength, endurance, movement skills).

Scheduling GPP & SPP

<table>
<thead>
<tr>
<th>Q1</th>
<th>Emphasis on GPP</th>
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</thead>
<tbody>
<tr>
<td>Q2</td>
<td>GPP &gt; SPP</td>
</tr>
<tr>
<td>Q3</td>
<td>SPP &gt; GPP</td>
</tr>
<tr>
<td>Q4</td>
<td>Emphasis on SPP</td>
</tr>
</tbody>
</table>
What does GPP look like?

• Physical training uniform v. tactical uniform
• Greater variety of events
• Often looks like sports camp
• Lot of teaching

What does military SPP look like?

• More PT time with military gear
• Less variety; more emphasis on tactical proficiency
• Operationally-relevant degree of volume and intensity
• A few, well-placed gut checks

Footmarch Progression from GPP to SPP

• Backward planning from end-state objectives
  • e.g., 60 lbs, 30 km, 10% elevation gain, 6-hour standard

<table>
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<tr>
<th>Q1</th>
<th>Emphasis on GPP</th>
<th>50% Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2</td>
<td>GPP &gt; SPP</td>
<td>70% Solution</td>
</tr>
<tr>
<td>Q3</td>
<td>SPP &gt; GPP</td>
<td>95% Solution</td>
</tr>
<tr>
<td>Q4</td>
<td>Emphasis on SPP</td>
<td>Meet operationally-defined objectives</td>
</tr>
</tbody>
</table>

Deployment
Methodical v. Random Approach to Training

- To the degree that specific abilities are required, a methodical approach is indicated
- Otherwise, it is difficult to ensure mastery of critical skills and abilities

Managing ECP Workouts: Before, during and after participation

Criteria for Participation

- Pre-participation medical examination
  - Identify medical conditions: HTN, heat injury hx, mTBI
- Pre-participation movement screening
  - Example: Functional Movement Screen
- Initial training sessions
  - Establish baseline fitness
    - strength/endurance/mobility
  - Education on self-monitoring and regulation
  - Warning signs of injury
In order to do this...

...we need to optimize this:

- Mobility
- Force Production
- Neuromuscular Control
- Endurance (Work Capacity)

Sample Power-Endurance Workout

**Purpose:** Improve power-endurance performance and maintain mental focus in the face of deep fatigue

- **Structure**
  - Complex movements and/or risky activities first
  - Sequence to avoid excess local muscular fatigue
    - Alternate primary muscle groups or dominant plane of movement
- **Order**
  - Turkish Get-Ups
  - 8-12 reps with each arm
  - Rotational resistance (L/R, 3x20s)
  - Kettle-Bell Swings (3-4x10)
  - MedBall Throws (variable parameters)
  - Air Squat/Push-ups/Pull-ups (or elbows to knees)
  - 15/10/5 reps per minute x 15-30 minutes
  - Anaerobic Big Finish (race pace)
    - Row (500M), Run (400/800M), Bike (max distance in 2-min)
The Role of Recovery

- Overload-Recover-Repeat-Progress
- Scheduling recovery
  - Between efforts within the same session/day
  - Weekly
  - Monthly
  - Yearly

Recovering from ECPs

- Avoid too much competition level load/intensity/volume
  - Don’t beat your head against the wall for time every day of the week

Training Maxim

“On our hard days we don’t train hard enough; on our easy days we don’t train easy enough.”
Recovering from ECP Workouts

- Make sleep a priority
  - Plan around it

Recovering from ECP Workouts

- Fuel the machine
  - Enough calories
  - Nutrient content
  - Nutrient timing
  - Hydration

Summary

What we've learned

- Risk of ECPs is poorly defined
- Training principles vary widely among ECPs
  - Often, but not always at odds with evidenced-based training practices
- Actual practice of ECPs often contradictory to stated principles

Recommendations

- Analyze the physical requirement
- Assess the individual
- Design the program based on best evidence
  - Lay a foundation
  - Progress systematically
  - Plan recovery
- Focus the passion
References

- Victoria: National Coaching Institute British Columbia & Advanced Training and Performance Ltd.
References