# TABLE OF CONTENTS

**PRE-SEMINAR**
- Seminar Information .................................................. 4
- Understanding CrossFit Endurance ................................. 5
- Mobility WOD Drills .................................................. 6
- Running Drills .......................................................... 6
- Reading Materials ..................................................... 6

**SEMINAR**
- Running Mechanics & Performance ............................... 8
- Injury & Prevention .................................................. 16
- Fueling the Endurance Athlete ................................ 20
- Nutrition ..................................................................... 20
- SMR & Mobility .......................................................... 25
- Training the Endurance Athlete ................................... 26

**POST-SEMINAR**
- 6 Week Homework Video Links .................................... 39
- 6 Weeks of Run Technique (Homework) ......................... 40
- Tempo Trainer Running Cadence Chart ......................... 43
- Running Technique Basic Drills Sheet ......................... 44
- Beginner Running Practices ....................................... 45
- Advanced Running Practices ..................................... 46
- Distance Sets ............................................................ 48
- Strength and Conditioning Recovery .......................... 48
- Race Warm-Up & Pacing Strategies .............................. 49
- Running Technique Sheet ........................................... 51
- CrossFit Endurance Warm-Up ................................... 52
- Foot Exercises ............................................................ 56
- CrossFit Endurance Running Drills .............................. 59
SEMINAR INFORMATION

Each day begins at 8 a.m. and goes until 4 p.m. with a 1 hour lunch break.

Please come in comfortable clothing ready to workout. Dress weather appropriate as we spend time outdoors.

We are honored that you have chosen to participate in the CrossFit Endurance Trainer Course. CrossFit Endurance has seen substantial growth in the last year and we have you, the CrossFit Endurance Community, to thank.

There will continue to be new things added to CrossFit Endurance as new and different needs of athletes are identified. We encourage your active participation in all we have to offer.

We cover the mechanical, conceptual, and theoretical foundations of CrossFit.

Endurance. We video tape to determine a starting point for each athlete. We review this as a group. We have alternating sessions demonstrating basic movements and skill development, with presentations of the conceptual basis of CrossFit Endurance, and a workout to drive home application of the materials. You are encouraged, but not required to participate in the physical portions of the seminar. For those who may have an injury we recommend that you participate in as many of the skill building activities as you see fit.

In preparation for the seminar you should familiarize yourself with fundamental CrossFit Endurance terminology (TT, Tempo, interval etc). These are found on the website in the workout legend, and FAQ pages.

We look forward to working with all of you.

Regards,

Brian MacKenzie & The CrossFit Endurance Coaching Staff
UNDERSTANDING CROSSFIT ENDURANCE

CFE DEFINED
CrossFit Endurance is an endurance sports training program dedicated to improving performance, fitness and endurance sports potential. We inspire, coach, and provide our community with the most aggressive and proven fundamentals of sports science, exercise physiology, nutrition, and athletic training protocols.

We are the leaders in strength and conditioning for endurance athletes. We have been guiding athletes, educating coaches and providing premier content to the endurance communities with tremendous success. Our passion is endurance sports. Our goal is to show a path that has not been illuminated. Our training principles work.

We are not for everyone, only for those who want to have a home in which they can grow both mentally and physically as an athlete to realize their chosen potential.

THE INNOVATION
Power and speed are critical components to success in the endurance world. With careful planning, our strength and conditioning plan increases these two mainstays of performance while decreasing recovery time, reducing injury, promoting preservation of lean tissue and creating a more sustainable performance curve.

We focus on eliminating unnecessary volume of training while increasing intensity. Our programming is structured, sport-specific and seamlessly integrated with Olympic lifts, powerlifting, gymnastics movements, explosive activity and mobility-based support. Everything we do focuses on midline stabilization and working from the inside out. Our strength and conditioning approach for endurance athletes is unparalleled. We incorporate the CrossFit fundamentals of being constantly varied. Repetition is the enemy and results in a decreased ability to build fitness.

Make no doubt, our program is not easy, but we believe the journey is part of making the results more rewarding. Our design is to maximize you as an athlete and to elevate your fitness. Our commitment to you is that we will coach, inspire, lead and educate with care, sincerity and a relentless motivation to finally get you where you want to go!

THE PLEDGE
Be UnScared. If you are not getting the results you want or if you don't perform, feel or look the way you want, allow us to provide the solution through our programming and community. CrossFit Endurance was created by experienced athletes and coaches. We provide only the best in proven methods.

Traditional training results in athletes being less powerful, less lean and more prone to injury, low energy and abbreviated sport longevity. We will make you faster. We will make you leaner. We will increase your power. We follow the CrossFit model while adding precise training protocols for endurance. We make you lift heavy. We make your lungs burn. But we make you happy!

Eat clean (lots of veggies, little fruit and starch, lean meats, essential fats, nuts, no grain, no
dairy, no bread, no sugar, no GMO, no refined or processed foods), train like a freak and make every meter and every rep mean something. We don’t have time to waste time; we do have time to accelerate ability.

We welcome you to explore our website (www.crossfitendurance.com), experience our programming, ask questions, and attend one of our detailed seminars around the world. We encourage you to stop thinking and start doing. We revolutionized endurance training.

MOBILITY WOD DRILLS

Below are links to the Mobility Wod Episodes posted by Kelly Starrett which target running specific areas. Spending time doing this will help you to be the most prepared you can be entering our seminar weekend.

Episode 77/365 Plantar Fasciitis
Episode 142/365 Tight IT Band and Hip Flexor Fix: Runners?
Episode 194/365: Why Do You Hate Your Calves?
Episode 249/365 Improving Hip Extension (And Internal Rotation) For Running
Episode 305 Solving Problems With The Tunnel: The Foot Strike
Episode 318/365: Knee Pain On Stairs or Hills
Episode 319/365: Protect Those Heel Cords Man!

There is a more complete list on our site if you go to the seminar prep drop down from the seminar tab.

and episodes that hit additional areas on the Mobility

RUNNING DRILLS

Please review the Running Drills with Brian MacKenzie series from the CrossFit Journal. You will need a subscription to the CFJ to access the videos.

Subscribe here
Running Drills With Brian MacKenzie Part 1
Running Drills with Brian MacKenzie Part 2
Running Drills with Brian MacKenzie Part 3
Running Drills with Brian MacKenzie Part 4
Running Drills with Brian MacKenzie Part 5
Running Drills with Brian MacKenzie Part 6

It is not a necessity, but is recommended that you purchase this product and bring it to the seminar. It is needed to complete the 6 week homework from the seminar.
RUNNING MECHANICS & PERFORMANCE

CFE/TRADITIONAL PROGRESSION HIERARCHY

Traditional Model:
1. Volume
2. Intensity
3. Technique/Skill

CFE Model
1. Technique/Skill
2. Intensity
3. Volume

Traditional protocols simply add more time and volume to periodize one’s body to be able to race that time or distance. CFE demands attention at the technique level, then tests the technique under stress (intensity), then develops increased stamina through technique executed under stress with more weight, time or weight volume.

WHAT FACTORS ARE INVOLVED IN RUNNING FAST?
The more we recruit gravity to move forward, the less “work” has to be done to move forward. Two of the best runners of all time who do this flawlessly are Usain Bolt and Michael Johnson.

THE CROSSFIT GENERAL PHYSICAL SKILLS
- Cardio Respiratory Endurance
- Stamina
- Strength
- Flexibility
- Power
- Speed
- Coordination
- Agility
- Balance
- Accuracy

This seminar addresses many of the “software” elements of these skills (bottom 4). The “hardware” elements must be respected (top 4). Power & Speed are byproducts of the top 4 & bottom 4.


CONVENTIONAL RUNNING THEORY

- Munro postulates applying increased ground reaction force (pushing) to increase acceleration of the centre of mass.¹
- Hunter found that it was not advantageous to have large vertical impulse during the acceleration phase of a sprint. Their fastest runners only produced moderate vertical impulses.²
- The quadriceps & hamstring muscles contract during early support during knee flexion. These muscles are therefore resisting the work of gravity, as the body lowers from foot contact to mid-stance.³
- According to scientific data, extensor’s muscle activity begins to decrease and ends about 30% before toe-off. This will negate extension of the knee and hip or pushing off.⁴

Conventional theory demands that movement forward is generated by pressure exerted in the opposite direction (pushing). In doing so, there is a significant draw on both quadriceps and hamstrings that can exhaust one’s muscles prematurely. Neither one of these muscles is capable of producing forward propulsion.

THE CONCEPT OF EFFICIENT RUNNING

- Movement is built on an infinite number of positions, through which the body moves in space and time
  - The deadlift, squat and press all have defined positions for beginning, middle and end.
  - So does running!
- It is important to note that the body cannot move forward until the center of mass passes the ball of the foot (pivotal point of support).
- Each movement starts and ends in a defined position.
- There is only one ideal position for intended movement (running).
- The closer we get to ideal position, the more efficient the movement is.
- Movement is a constant change from one position to another on the timeline of movement duration.

Define a running starting position (in our case, figure 4).

Establish appropriate fall for speed desired.

Define the finish position (figure 4 on other leg).

Define the easiest way to move from start to finish (figure 4, fall, pull).

---

¹ Munro et al., 1987; Weyland et al., 2000
² Hunter et al., 2005
³ Elliot & Banksby, 1979
Table 1.

<table>
<thead>
<tr>
<th>THE CONCEPT OF EFFICIENT RUNNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POSITION</strong></td>
</tr>
<tr>
<td>(establish figure 4 position—high stability)</td>
</tr>
<tr>
<td><strong>FALL</strong></td>
</tr>
<tr>
<td>(loss of balance—movement. Maintain stability)</td>
</tr>
<tr>
<td><strong>PULL</strong></td>
</tr>
<tr>
<td>(dynamic stability—shifting support from beginning to ending position)</td>
</tr>
</tbody>
</table>

**BASIC PRINCIPLES OF EFFICIENT MOVEMENT**

Work WITH the laws of nature, not against them.

- You go where your body weight goes.
- Muscle activity should “service” your body weight, not the other way around.

Gravity ⁵

Ground reaction ⁶

Muscle elasticity ⁷

Muscle contraction ⁸

Gravitational Torque

Momentum/Inertia

These 6 forces are the drivers and areas for focus when considering successful running technique. Don’t believe the power of gravity? Pick up a PVC…

**POSITION**

- All movement begins & ends with a specific position.
- Requires accuracy, agility, balance, and coordination, therefore it is a skill.
- Figure 4 is the position from which falling begins.
- Keys: Midline stable, gymnastic/hollow “set”.

Optimal position=one knee bent to create a figure “4” position; head position neutral; bent support knee; “quiet” upper body; shoulders externally rotated.

---

⁵ Graham-Brown, 1912
⁶ Cavagna & Lafortune, 1980
⁷ Cavagna et al, 1964
⁸ Heise et al, 1996
GRAVITY
- The strongest mechanical force among the forces in nature.
- Anokhin stated, “all biological systems, the most essential characteristics of it, are defined by the Universal Law of Gravity.”
- Leonardo Da Vinci was the 1st to recognize gravity as a propulsive force, when he stated, “motion is created by the destruction of balance, that is, of equality of weight for nothing can move by itself which does not leave its state of balance and that thing moves rapidly which is furthest from its balance”.
- Fen following extensive work on running found that his fastest runner, in comparison to a slower runner had his centre of mass further forward during stance (an increase in body fall).

Gravity is the most powerful force we can harness. The more we embrace gravity, the easier it is to run. The more we fall, the faster we run.

FALL: ROTATION AROUND POINT OF SUPPORT
Using Gravitational Torque

AGAIN: It is important to note that the body cannot move forward until the general center of mass passes the ball of the foot (pivotal point of support)

Much like our PVC example, our position must be solid from foot to shoulder. Once our posture is established movement is initiated by moving/allowing our general center of mass forward. Retention of this fall and stable midline defines our speed of movement.

\[ F = mg \times \sin \alpha \]

Figure 2.

---

9 Keele, 1983: p. 173
10 Keele, 1983: p. 173
11 Fen, 1930
3 Simple Keys:

- Use gravity to help. It's the strongest, most natural force.
- Movement is a result of the destruction of balance.
- Use torque to redirect energy for movement.
ANGLES OF FALLING: MORE FALL - MORE SPEED

- Depending on the amount of gravity utilized, the body immediately knows the quality and quantity of muscles’ efforts that should be applied in the particular movement.
- This is ingrained in the human body through a process of millions years of evolution.
- Slower running only requires 1-5 degrees of lean. We utilize a small amount of gravity transferring to the horizontal component. For faster running, we use more fall as it helps us utilize more gravity for forward movement.

Speed is governed by the angle of fall, not by pushing backward. Position never changes, however, degree of fall does... more fall = more speed.

VARIATIONS OF CORRECT RUNNING
A 5.5 degree fall will deliver a 4:08 mile split. Usain Bolt runs the 100m dash with an average 18.5 degree and maximum 21.4 degree fall. Foot recovery height is indicative of speed.
### PULL: WITH HAMSTRINGS FOR CHANGE OF SUPPORT

- Use ground reaction and muscle elasticity instead of muscular energy.
- Minimal compact movement.
- Stride frequency is critical.

A forefoot ground strike capitalizes on maximal muscle elasticity. The movement from ground strike to “figure 4” is controlled by hamstring contraction. The rate of this pulling motion is in harmony with cadence.

### STRIDE FREQUENCY

- Very similar to cycling
- Minimum of 90 cadence (180 steps per minute) is necessary for ground reaction and muscle elasticity to work together and save muscular effort
- Monitor with a Seiko Metronome / [www.frozenape.com](http://www.frozenape.com) (iPhone App) / Or any metronome that will set to 90 cadence or faster
- Good runners pull the foot straight up

Higher cadence equals faster speed. As the lean/fall increases, stride frequency must increase to handle incremental torque. Range is 90-130 steps per minute, per foot (130 is world class).
RUNNING ERRORS
- Poor body posture (bent at waist “K”)
- Landing in front (braking)
- Landing on heel (no elasticity)
- Landing on straight leg (knee load = sheer force)
- Pushing off in back (creating lever)
- Foot on ground too long (prolonged contraction)

Almost all sources of error/pain can be sourced to these 6 areas. Running error communication should be kept simple! Find the source of the error, prescribe the solution.

FOCUS ON 3 KEYS
- Posture- retain midline stability
  » Midline stability: The midline is the entire spine, and its stability is dependent on the core and all the prime movers of the body. This includes the hip, glutes, and hamstrings. Excessive tightness in any of the prime movers affects the core muscles, often resulting in low back pain.
- Falling - use gravity to your advantage (efficiency)
- Pulling - foot straight up (pull insertion towards origin)

This concept takes minutes to learn, but a lifetime to master! Whenever you lose your way, come back to the basics. Everything begins with posture, if it is not correct, your fall and pull will be sub-optimized.

KEY TECHNIQUE AREAS
- Maintain 90+ cadence
- Stay compact
- Do as little work as possible = efficiency of movement

This quick list of basics reinforces what to do to maximize efficiency and speed.
INJURY & PREVENTION

INJURIES AND ERRORS
Upon close reflection, it is fairly clear why modern running science and medicine has not addressed running technique as the main cause for injuries:

- There was no standard of running technique.
- An error is a deviation from the standard. **If there is no standard then there is no error in technique.**
- If there is a standard in technique, any deviation from it is an error. Errors in technique are the cause of injuries.
- Start position = finish position tunnel example

Putting your body in an inefficient position for the intended task (Proper Set-Up/Position = Efficiency & Less Injury).

TWO MAJOR RULES WHICH CAUSE INJURIES

- Stopping a movement
- Creating leverage

Stopping a movement and creating leverage force tissue to move in a direction that can cause undue stress. We want to prevent ourselves from any such stressful activities.

MUSCLES LOADING

- Both rules are primarily about how much we work against gravity.
- When we reduce our work against gravity, injuries are reduced.
- If we increase the amount of work against gravity, injuries increase.

Running ‘faster’ instead of ‘harder’ will help ingrain this concept. Harder implies greater muscle contraction rather than leaning. Run fast, not hard. Retain muscle elasticity at all costs in all movements.

RUNNING ERRORS

- Poor body posture (bent at waist “K”)
- Landing in front (braking)
- Landing on heel (no elasticity)
- Landing on straight leg (knee load=shear force)
- Pushing off in back (creating lever)
- Foot on ground too long (prolonged contraction)

Almost all sources of error/pain can be sourced to these 6 areas. Running error communication keep it simple. Find the source of the error, prescribe the solution.
COMMON INJURIES IN RUNNING

- Improper Movement Patterns
- Unnecessary muscle activation
- Muscle work against gravity and bodyweight
- Too much distance and speed for skill
- Make technique changes from the ground up

Use this slide as a cheat sheet on diagnosing running injury. All injuries are the result of stopping a movement or creating leverage. It is vital to understand that injury comes from a deviation from a standard.

CALF STRAIN / TEAR & ACHILLES TENDONITIS

Causes

- Weakening of muscle fibers
- Overstressed tissue

Why

- Toe landing
- Toe push off
- Tight calves

When our calf is over articulated it causes muscle overload and the creation of leverage. Undue leverage without enough strength causes the muscle to tear. A loose foot and greater muscle elasticity will prevent such injury from occurring.

PLANTAR FASCIITIS

Causes

- Too much load on the plantar fascia leads to tissue breakdown

Why

- Toe landing
- Excessive push off
- Tight calves or Achilles tendon
- Primarily gastroc soleus

Treating plantar fasciitis over the long term requires correcting technique issues, improving foot mobility, and strengthening the weak fascia.
ITB SYNDROME

Causes
- Heel striking out in front of GCM
- Landing on outside of foot

Why
- Weak muscles
  - Glute Medius
  - Vastus Medialis
- Tight lateral quad
- Adhesions
  - In IT band
  - Lateral Quad
- Knee diving in during:
  - Run
  - Workout

IT pain is generated from the IT band rubbing back and forth across the bone on the outside of the knee. Long term resolution must feature a lengthening of the IT band (stretching), strengthen glutes, and myofascial release.

PATELLAR – FEMORAL DYSFUNCTION AND PATELLAR TENDONITIS

Causes
- Patella not sliding within the femoral groove properly
- Tissue breakdown at patellar tendon

Why
- Tight quads/weak vastus medialis oblique (VMO)
- Weak gluteus medius
- Sitting for extended periods

“Runner’s knee” is caused by the shifting back and forth of the patella tendon brought on by ground reaction force meeting tight quads and weak glute muscles. Increased strength in the glutes and quads will allow for less stress on patella tendon.
LOW BACK PAIN

Description of Pain
- Generally in and around low back
- Achy pain typical
- Pain shooting through the glutes
- Pain radiating down the leg

Why
- Tight and weak hips creates unbalanced torsion on low back
- Weak midline/core
- Heel Strikers
- Over rotation of upper torso
- Forward lean
- Muscle imbalances

Heel striking is the primary source of lower back pain. Such pain can also be exacerbated via over rotation of the upper body. More erect posture and forward hip position will relieve ground concussions.

TREATMENTS
- Treatments may vary, but prioritizing how you go about treatments will enhance the effectiveness of the treatment. Treat muscle stiffness first.
- Find the weak muscles and strengthen them, work proper mechanics re-evaluate form, & progressions.
- Remember, if you’ve injured a tissue, you’ve got to treat that tissue AND solve the mechanical problem that caused that tissue to load poorly in the first place.

Prioritize how you treat an injury. Inflammation reduction, technique analysis and strength improvement are places to start. Remember to go up/down stream from the injury to ensure comprehensive treatment.
FUELING THE ENDURANCE ATHLETE

NUTRITION

Fueling is a skill and must be practiced and perfected just like accuracy, agility, balance and coordination. If we have to prioritize training, recovery and nutrition, nutrition is #1, the other two can be monitored by outside observation.

WHAT DO WE EAT?
Are you eating to train or training to eat? Ultimate performance is fueled by ultimate quality of food and hormonal management of insulin and glucagon. How are you fueling your engine?

HOW DOES IT WORK?
Carbohydrate stores in the liver and skeletal muscle are limited to about 2,500 to 2,600 kcal of energy, or the equivalent of the energy needed for about 40km of running. Fat stores can provide more than 70,000 kcal of energy.

GLUCONEOGENESIS
Protein can be used as a minor energy source under some circumstances, but it must first be converted into glucose. The process by which protein or fat is converted into glucose is called Gluconeogenesis. Protein can provide upwards of 5-10% of the energy needed to sustain long duration exercise.

HORMONES AND RESPONSE TO ENERGY
This graph simply demonstrates your body’s response to the ingestion of various macro food groups—ultimately we want to limit insulin production and train our bodies to utilize fat as its primary source of energy via ingestion of PRO and FAT.

ENDURANCE FUELING HAS THREE SOURCES
Nutrition
- During exercise the body’s nutrition demands change based on the duration of event.
- Shorter events draw upon glycogen stores while events over 18 hrs utilize more fat.
- Shorter events draw up pre/post hydration & nutrition more than fueling during the race or event.

Hydration
- 70% of our body is water, 75% of mitochondria weight is water.
- Minimum water consumption should be 16-20 oz. per hour, however, this can be as high as 34 oz. in extreme conditions.
Electrolytes
- Electrolytes are sodium, chloride, potassium, magnesium and calcium.
- These minerals help retain water in and across your body including your muscles.

Human hierarchy of needs demands that oxygen, hydration and THEN nutrition must be addressed in that order—tend to each need state and plan/execute accordingly.

**NUTRITION HIGHLIGHTS**
- The body can retain about 1800-2200 calories of glycogen when fully fueled.
- During intense exercise, the body can burn 600-1500 calories per hour.
- Unfortunately we can only absorb 200-600 calories per hour.
- Based on the duration of the event, our refueling strategies must be flexible and call upon different sources of calories.
- Key = get a nutrient return for what you ingest! Macronutrients should have high nutrient density (food is fuel)

**Table 2.**

<table>
<thead>
<tr>
<th>YOUR FUEL STORES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CARBOHYDRATE</strong></td>
</tr>
<tr>
<td>Location</td>
</tr>
<tr>
<td>Liver Glycogen</td>
</tr>
<tr>
<td>Glucose in Body Fluids</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>

| **FAT**                                                                          |
| Location                           | g  | Kcal  |
| Subcutaneous & Visceral            | 7,800 | 73,320 |
| Intramuscular                      | 161  | 1,513 |
| TOTAL                              | 7,961g | 74,833 k/cal |

Glucose & Glycogen are much more readily available than FAT provides a much larger source of fuel
NUTRITION FUELING PROTOCOL

<120 Minutes
- Primary fuel is glycogen (depending on intensity of event for the individual)
- Hydration goal should be 16-20 oz. per hour with temps under 80 degrees

2-4 Hours
- Glycogen is depleted (this is a clue that nutrition planning needs to happen long before this point)
- Fueling transitions from glycogen to glucose and fat
- Have a target of specific fuels that work for YOU and stick to it.
- Gels?
- Fats (Good Fat vs Bad Fat, medium chain triglycerides)
- Protein (What sources are optimal and can you handle? Chicken Breast, Whey, Casein?)
- All?
- Electrolytes begin to have a larger role

Activities under 90-120 minutes require no additional calories. Length of event will determine sources of calories. Higher intensity events will draw down glycogen stores faster than lower intensity efforts.

NUTRITION FUELING PROTOCOL

4 Hours+
- Intensity is less
- Fat becomes primary source of fuel
- CHO must continue if you already started (the vicious cycle)
- Electrolytes must be replaced 500-2000 mg per hour

12-18 Hours+
- CHO contributes less vs. much higher at lower more intense levels
- PRO is a necessity
- Fat bears most of the energy
- Electrolytes and water prescription remains same as 4–12 hr. markers
- Potassium should be replaced 1X every 3-4 hrs (via electrolytes or banana)

Longer efforts will feature lower heart rates allowing for ability to digest PRO and FAT in addition to CHO. While these are very good guidelines, nutrition is very personal and must be tested in training under various conditions.

HYDRATION HIGHLIGHTS
- For most athletes training/racing over 60 minutes at 72-76 degrees, 16-20 oz. per hour is an adequate target
- To confirm targets for higher temperatures, please visit this consumption calculator.
- With a 3% loss of water dehydration occurs.

---

12 The Paleo Diet for Athletes, Cordain, 2005
13 The Paleo Diet for Athletes, Cordain, 2005
Dehydration Levels

- <2% Manageable loss
- 5-6% Sleepiness, headaches, nausea, tingling in arms
- 10-15% Muscles lose control, hearing impaired, dim vision
- 15% Death

Nutrition is only 1/3 of your fueling strategy. Hydration and electrolyte management are the other 2. Drinking half your bodyweight in water should be an everyday hydration strategy (i.e. 150lb person should be drinking 75 oz. per day)

ELECTROLYTE HIGHLIGHTS

- Electrolyte management is vital in endurance efforts
- Both under and over prescription of electrolytes can be fatal
- Hyponatremia- Caused by sodium loss in blood due to under consumption of electrolytes usually due to indulgence of water. In extreme cases, this sodium free blood travels to the brain, permeates brain cells, causes brain swelling and causes death.
- Hypernatremia- Is caused by an elevated level of sodium in the blood. While over consumption can be a driver of this condition, it is more commonly associated with dehydration as the increased level of sodium is more often caused by a lack of water ingestion.

Electrolytes are the “glue” for your hydration strategy—without them, hydration will not be retained by the body. This can result in dehydration and sub par performance

ELECTROLYTE MANAGEMENT

- Electrolyte management can be very personal and can vary dramatically from athlete to athlete.
- The only way to confirm one’s electrolyte needs is to perform a sweat rate test.
- Alberto Salazar (one of America’s greatest marathoners) lost over 80 oz. of sweat per hour.

Sweat Rate Protocol

- Weigh yourself without clothes
- Perform a 60 minute time trial at goal race pace in a temperature controlled environment
- Weigh yourself after effort
- Subtract 1 lb for every 16 oz. of water consumed during time trial
- Once you have confirmed total weight loss, you can then correlate each pound lost with the following loss in electrolytes:
  
  220mg of Sodium
  63mg of Potassium
  8mg of Magnesium
  16mg of Calcium

Performance of this protocol is critical to determine your athlete’s personal sweat rate and should be treated with as much reverence as any time trial effort.
### ELECTROLYTE GUIDELINES

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Role</th>
<th>Target Dose per 8 oz of water</th>
<th>Daily Performance Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>Muscle Contraction Nerve Transmission</td>
<td>150-250mg</td>
<td>1500-4500mg</td>
</tr>
<tr>
<td>Chloride</td>
<td>Peak Muscle Function</td>
<td>45-75mg</td>
<td>45-75 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>Muscle Contraction Nerve Transmission Glycogen Formation</td>
<td>50-80mg</td>
<td>2500-4000mg</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Muscle Relaxation ATP Production</td>
<td>20-30mg</td>
<td>400-800mg</td>
</tr>
<tr>
<td>Calcium</td>
<td>Bone Health Nerve Transmission Muscle Contraction</td>
<td>10-15mg</td>
<td>1200-1600mg</td>
</tr>
</tbody>
</table>

Sodium is the major driver of electrolyte success, but the others must be tended to as well. Saltstick.com is our preferred choice as its potency and electrolyte proportions are identical to sweat.
SMR & MOBILITY

SELF MYOFASCIAL RELEASE (SMR)
• SMR is a soft tissue therapy used to treat pain and dysfunctional tissue.
  ▪ Improve mobility of tissues (sliding surfaces)
  ▪ Relaxing contracted muscles (trigger points)
  ▪ Increasing blood flow
  ▪ Lymphatic drainage
  ▪ Stimulating the stretch reflex
• Fascia
  ▪ Connective tissue surrounding muscles, bones and joints
• Foam rollers, Yoga Tune Up balls, massage stick, rumble rollers, etc.

<table>
<thead>
<tr>
<th>KEY AREAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lower Leg (front/back)</td>
</tr>
<tr>
<td>▪ Hamstring (insertion)</td>
</tr>
<tr>
<td>▪ Quadriceps</td>
</tr>
<tr>
<td>• Adductors</td>
</tr>
<tr>
<td>▪ IT Band/Lateral Hip Rotators</td>
</tr>
<tr>
<td>▪ Lumbar Spine</td>
</tr>
<tr>
<td>▪ 2 Balls Taped Together</td>
</tr>
<tr>
<td>• Plantar foot</td>
</tr>
<tr>
<td>• Calf</td>
</tr>
<tr>
<td>• Quadriceps</td>
</tr>
<tr>
<td>• IT Band/Lateral Hip</td>
</tr>
<tr>
<td>• Hip External</td>
</tr>
<tr>
<td>• Hip External Rotators</td>
</tr>
<tr>
<td>• Lumbar</td>
</tr>
<tr>
<td>• Thoracic Spine</td>
</tr>
<tr>
<td>• Spinal Erectors</td>
</tr>
</tbody>
</table>

Table 4.

KEYS TO SUCCESSFUL SMR
• Consistency
  ▪ One treatment will not “fix” your problems. You must make it a habit.
• Pain is not the goal
  ▪ SMR is uncomfortable, but not a toughness test.
• Upstream/Downstream
  ▪ Must treat areas above and below the problem area.
• Supplemental treatment
  ▪ Just “beating up your tissues” is not enough. Don’t forget to address technique, mobility, and ROM.
TRAINING THE ENDURANCE ATHLETE

TRADITIONAL
LSD is defined as “long, slow, distance” and features either a time or distance measure of progress. This effort level is rarely if ever above $70\%$ and time/distance increases $10\%$ every week for 3 weeks then decreases $15\%$, repeated until top distance/time achieved; Periodization.

CROSSFIT
Constantly Varied, Functional Movement at High Intensity… It is broad, and seeks use of all domains with intensity rarely below $80\%$.

CROSSFIT ENDURANCE
1st Word = CrossFit, 2nd Word = Endurance: Refers to cardio respiratory endurance, or one’s ability to maintain aerobically for desired time. CFE: brings a structured strength and conditioning to sport!

Traditional endurance modalities are reduced to a discipline performed longer or farther than the week before at an intensity level that is almost always conversational and rarely intense. CrossFit Endurance builds on a CrossFit base through increased stamina efforts (time trials, intervals).

AEROBIC TRAINING
Benefits
- Increased cardiovascular function
- Better fat utilization
- Greater capillarization
- Increased mitochondrial growth

Drawbacks
- Decreased muscle mass
- Decreased strength
- Decreased power
- Decreased speed
- Decreased anaerobic capacity
- Decreased testosterone/hormone levels
- Extended fatigue

Traditional, monostructural aerobic training offers many cardiovascular and fat burning advancements, but at a cost of significant decreases in many anaerobic functions.
ANAEROBIC TRAINING

Benefits

- Increased cardiovascular function
- Decreased body fat
- Increased muscle mass
- Increased strength
- Increased power
- Increased speed
- Increased aerobic capacity
- Greater capillarization
- Increased mitochondrial growth

Drawbacks

- Might require an aerobic foundation depending on sport
- Increased intensity
- Skill should be understood/trained

Contrary to public belief, anaerobic training expands aerobic capacity as well as increases and fuels muscular endurance activity. Either system overdone, will cook the athlete.

ENERGY SYSTEMS

At the highest intensity, from sprints less than 10s to endurance events greater than 30min, each of the energy systems is contributing to the total energy needs of the body. The aerobic system might be dominant at a longer duration but the anaerobic glycolytic system contributes some energy also. Pending the activity/sport all of the energy pathways are frequently utilized. Traditional protocols tend to ignore phosphagen, glycolytic and lactic pathway development.

AEROBIC TRAINING—A REVIEW

Traditional Model

1. Volume
2. Intensity
3. Technique/Skill

CFE Model

1. Technique/Skill
2. Intensity
3. Volume

Traditional protocols simply add more time and volume to periodize one’s body to be able to race that time or distance. The roles of intensity and technique are distant 2nd and 3rd place.
ENDURANCE

Cardio respiratory

- How long can you go aerobically for a desired amount of time?
- You can build your Cardio Respiratory system with Stamina & Intervals. 
  
> Endurance: the ability for one to maintain aerobically for desired amount of
distance or time. It also refers to suffering... Or one's ability to deal with pain!
The breakdown of your body in an endurance event has nothing to do with
aerobic activity though. This is a strength and conditioning issue.
> Stamina: simply put is the ability to prolong a very stressful situation. It
requires the ability to use all energy systems.
> “Stamina” as “gears on a car”. We must develop all pathways in much the
same way a powerlifter must develop speed strength, strength speed, power,
strength, etc.

In a nutshell, some people bake Thanksgiving turkeys for 3 hours, others deep fry them
for 15 minutes but still get the same result! We do the same with endurance athletes, high
intensity achieves aerobic performance while building anaerobic capacity. We mesh the
two together.

ANAEROBIC BACKED UP

- www.zone5endurance.com
- Lydiard A, Running to the Top, Meyers and Meyers Spor t, 1995, pgs. 41, 78, & 105
- Maffetone P, Training for Endurance; Guide for Triathletes, Runners, & Cyclists
- David Barmore Productions, 1996, pg 78
- Burgomaster K, Hughes S, Heigenhauser G, Bradwell S, Gibala M. Six Sessions of
sprint interval training increases muscle oxidative potential and cycle endurance
- Coyle, E. Very intense exercise-training is extremely potent and time efficient: a
- Runners Train Less and Be Faster:

For athletes looking for both diagnostic results and “real world” insights, the sources
above will offer them the examples they are interested in. Endurance Programming
ENDURANCE PROGRAMMING

Who is the athlete?

- Time trials define us. We must establish a series of time trial efforts that will define our starting point.
- Athlete History (experience, bio markers, performance markers, life/schedule).

What is the commitment level?

- How much time is the athlete willing to commit?
- What is the level of discipline they are prepared to commit to changing the way they eat?
- Are they prepared to commit to recovery protocols as aggressively as training protocols?

What is the athlete’s primary goal?

- Make the athlete define success—simply finishing a marathon is a dramatically different goal than breaking 3 hours. Participating and Racing are 2 different things!

Before we establish any training program, we must define a starting point, commitment level and objective. Establishing a defined goal is critical to make sure that the coach and athlete are aligned in terms of mutually defined success criteria.

DEFINING THE ATHLETE

Who is your Athlete? What are their sport specific goals?

- Time trial, i.e., 5k run, 500yd swim, 20-40k bike.
- Benchmark WODs accurate indicator of different time domains/distances.

The CF/CFE training protocol can be very dangerous if simply entered into without the proper awareness of current physical capability and skill sets. Establishing a beginning is critical in sharing progress with the athlete as the training protocol and goal setting steps are introduced.

PROGRAMMING THE ATHLETE

Regardless of goal, all athletes must execute a base regimen of 4-6 CrossFit WODs per week.

- CrossFit is the foundation of CFE training.
- CrossFit is not 4-5 metcons per week, it is constantly varied, functional movement performed at high intensity.
- Once our baseline of fitness has been established, we build upon it with incremental CFE WODs designed to build stamina and cardio respiratory endurance.
- Progression is key—very few, if any traditionally trained endurance athletes can simply jump into CF and begin properly executing 4-6 CF WODs per week.

Pancake analogy—what is in a pancake? (eggs, flour, water, vanilla, cinnamon, baking soda). If you remove the flour and baking soda, do you still have a pancake? No. If an athlete simply does 2 CF WODs per week and continues to train the way they used to, they are not training with CF/CFE.
PROGRAMMING CONTENT

- There are 3 buckets of CF content
  - Metabolic Conditioning
  - Gymnastics
  - Weightlifting

- There are 4 buckets of longevity of CF content
  - Phosphagen
  - Glycolytic
  - Lactic
  - Oxidative

- All of these variables must be executed to optimize performance
  - 1-1-1-1-1-1 Deadlifts is a complete WOD!
  - “Murph” is just as valuable as any other appropriate CF WOD

One can target 2 metcons, 2 weightlifting and 2 gymnastic based WODs, but remember, routine is the enemy! There is no “right” path, however, there are many wrong paths (constant metcons, constant heavy weight training).
### Table 5.

<table>
<thead>
<tr>
<th>EXERCISES BY MODALITY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gymnastics</strong></td>
<td><strong>Metabolic Conditioning</strong></td>
</tr>
<tr>
<td>Air-Squat</td>
<td>Run</td>
</tr>
<tr>
<td>Pull-ups</td>
<td>Bike</td>
</tr>
<tr>
<td>Push-up</td>
<td>Row</td>
</tr>
<tr>
<td>Dip</td>
<td>Jump Rope</td>
</tr>
<tr>
<td>Handstand Push-up</td>
<td></td>
</tr>
<tr>
<td>Rope Climb</td>
<td></td>
</tr>
<tr>
<td>Muscle-Up</td>
<td></td>
</tr>
<tr>
<td>Press to Handstand</td>
<td></td>
</tr>
<tr>
<td>Back Extension</td>
<td></td>
</tr>
<tr>
<td>Sit-up</td>
<td></td>
</tr>
<tr>
<td>Jumps</td>
<td></td>
</tr>
<tr>
<td>Lunge</td>
<td></td>
</tr>
</tbody>
</table>

These buckets offer a multitude of variety and functional movement that should all be programmed and incorporated into any CFE athlete’s regimen.

### Table 6.

<table>
<thead>
<tr>
<th>WORKOUT STRUCTURE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Days</strong></td>
<td><strong>Single-Elements Days (1, 5, 9)</strong></td>
</tr>
<tr>
<td>Priority</td>
<td>Element Priority</td>
</tr>
<tr>
<td>(intensity)</td>
<td>M: Long, Slow Distance</td>
</tr>
<tr>
<td>Workout Recovery Character</td>
<td>Recovery not a limiting factor</td>
</tr>
</tbody>
</table>

As we customize our programming, recovery and skill development will vary from athlete to athlete—the above construct is a format from which to draw more inspiration and direction to help prioritize progress.

---

Table 7.

<table>
<thead>
<tr>
<th>3 DAYS ON, 1 DAY OFF 17</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAY</strong></td>
</tr>
<tr>
<td><strong>M</strong></td>
</tr>
<tr>
<td><strong>W</strong></td>
</tr>
<tr>
<td><strong>W</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5 DAYS ON, 2 DAYS OFF 18</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAY</strong></td>
</tr>
<tr>
<td>wk1</td>
</tr>
<tr>
<td><strong>W</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>wk2</td>
</tr>
<tr>
<td><strong>M</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>wk3</td>
</tr>
<tr>
<td><strong>G</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Modalities**

**M** = monostructural metabolic conditioning or “cardio”

**G** = gymnastics, bodyweight exercises

**W** = weightlifting, powerlifting and Olympic lifts

As programming can vary drastically and be very intimidating to some coaches, this framework suggests various protocols for both 3:1 and 5:2 work to rest ratios.

---


PROGRAMMING CONTENT
CrossFit Endurance Content

- Running duration is from :20 to 1.5-2 hrs
- Interval sessions vary from :20 to 10-12 minutes
- Time trial efforts can range from as low as 10 minutes to 2 hrs
- CrossFit athletes will need to learn pacing, CFE athletes will need to learn intensity
- Cycling duration is from :20 to 1.5-2 hrs
- Interval sessions vary from :20 to 15-20 minutes
- Time trial efforts can range from as low as 10 minutes to 2 hrs
- Intensity and resistance should be added as desired
- Swimming duration is from :20 to 45 mins
- Time trial efforts range from 5 minutes up to 45
- Intervals range from Tabata up to 3-4 minutes
- Intensity should not compromise technique with any movement, but especially so in swimming

These time frames are for roughly 80-90% of your athlete population. Deviation from these frames should only be exercised as your athlete can recover appropriately—or to test nutrition protocols.

HOW WE ADDRESS VOLUME AND DURATION WITHIN THE CONTEXT OR TRAINING?
- Group Rides/Runs: they should be incorporated 3-5x a month pending the sport and race objective. Purpose: to get race simulation and random intervals to mimic race conditions.
- Longer duration/aerobic days: just as important to experience how to default back to skill and technique.
- Longer duration/aerobic days are also beneficial for allowing body to adapt to being in the saddle longer or being on your feet more.
- The Mental/Emotional State – longer days help to acclimate your mind to establishing a focus and acuity for demands of being “out” longer.
- The Key: there is purpose and intent to longer days and this is also a skill to be continually developed.

Longer Days are beneficial providing they are integrated into a well-thought program with proper progressions. These days should be timed and recorded like any other training day.

TEMPO VS. TIME TRIALS
Tempo: a percentage of ones pace or a specific pace outlined for a given period of time in a workout.
- Example: If you can run a 5k at a 6 min mile pace and instead of having you run hard, we have you run a 5k at 7:30 mile pace.
- This is not just limited to this type of run or distance. You could can also add tempo sections to longer runs.
- Example: 10k @ 7:30 pace w/ every odd 1k @ 6:30 pace.

Time Trial: Race Pace effort for that distance/time.
### Table 8.

#### BEGINNER WEEK CFE—SINGLE SPORT

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength–ME</td>
<td>Strength–ME</td>
<td>Strength–DE</td>
<td>Strength–DE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF</td>
<td>CF</td>
<td>OFF</td>
<td>CF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–45 mins</td>
<td>20–45 mins</td>
<td>20–45 mins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills &amp; Drills</td>
<td>Skills &amp; Drills</td>
<td>Skills &amp; Drills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI:</td>
<td>LI:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWIM</td>
<td>SWIM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>T/TT 5k TT</td>
</tr>
<tr>
<td>Repeat 200m, recover 2:00 until form/pace deteriorates</td>
<td>Repeat 800m, recover 2:00 until form/pace deteriorates</td>
<td>T/TT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### BEGINNER WEEK CFE—3 SPORT

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength–ME</td>
<td>Strength–ME</td>
<td>Strength–DE</td>
<td>Strength–DE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF</td>
<td>CF</td>
<td>OFF</td>
<td>CF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–45 mins</td>
<td>20–45 mins</td>
<td>20–45 mins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills &amp; Drills</td>
<td>Skills &amp; Drills</td>
<td>Skills &amp; Drills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI:</td>
<td>SI:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWIM</td>
<td>BIKE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeat 50m, recover 2:00 until form/pace deteriorates</td>
<td>Repeat 1K, recover 2:00 until form/pace deteriorates</td>
<td>SI:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RUN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SINGLE SPORT ENDURANCE
- 4–6 CrossFit Workouts Per Week
- 2–3 Endurance Workout Per Week
  - One Short Interval
  - One Long Interval
  - One Tempo/TT (Rotate each week)

If the athlete can only complete 2 Endurance WODs a week alternate the type of WODs completed. Always include short interval as one of the WOD types completed.

### MULTI SPORT ENDURANCE
- 4–6 CrossFit Workouts Per Week
  - Depends on Athlete
- 1–2 Endurance Workouts Per Sport, Per Week
  - One Short Interval
  - One Long Interval or One Tempo/TT (Rotate each week)
Table 9.

### BUILD WEEK 4-5 (HAL HIGDON NOVICE)

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest</td>
<td>3 Mile Run</td>
<td>4 Mile Run</td>
<td>3 Mile Run</td>
<td>Rest</td>
<td>9 Mile Run</td>
<td>Crosstrain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest</td>
<td>3 Mile Run</td>
<td>5 Mile Run</td>
<td>3 Mile Run</td>
<td>Rest</td>
<td>10 Mile Run</td>
<td>Crosstrain</td>
</tr>
</tbody>
</table>

### BUILD WEEK 4-5 CFE

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF</td>
<td>CF</td>
<td>CF</td>
<td>Off</td>
<td>CF</td>
<td>CF</td>
<td>Off</td>
</tr>
<tr>
<td>SI: Repeat 400m, recover 2:00 until form/pace deteriorates</td>
<td>LI: Repeat 800m, recover 2:30 until form/pace deteriorates</td>
<td></td>
<td></td>
<td></td>
<td>T/TT 8M TT</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF</td>
<td>CF</td>
<td>CF</td>
<td>Off</td>
<td>CF</td>
<td>CF</td>
<td>Off</td>
</tr>
<tr>
<td>LI: Repeat 1km, recover 3:00 until form/pace deteriorates</td>
<td>SI: Repeat 200m, recover :90 until form/pace deteriorates</td>
<td></td>
<td></td>
<td></td>
<td>T/TT 10k @ 85% race pace</td>
<td></td>
</tr>
</tbody>
</table>
3 x 15 Glute Ham Developer Sit-ups (make sure you are extending knees aggressively to come up… your quads should also burn on this).
3 x 15 Glute Ham Developer hip extensions (hamstrings and butt should burn)
3 x 15 Kettlebell/Dumbbell Swings
3 x 15 Bench Press
3 x 15 Pull Ups

Why? To accelerate recovery & get rear chain/hips to “open up” and mobilized. All exercises with light–medium weight. 3 sets! Reps are until you feel burn in target area or prescribed amount—This is not a timed WOD.
LEARNING TO DO IT FASTER
Examples of why training load or speed should increase:

- Intervals become easier
- Quicker recovery
- Athlete gets faster at interval training
- Athlete is faster at time trials or PR’s a swim, bike, run
- Athlete PR’s benchmark WOD
- Athlete continues to get stronger

Programming is very personal and needs to be tailored to the athlete’s goals, athletic background and ability to recover. Tools like https://www.mcmillanrunning.com/ can be used to benchmark efforts and track progress against predetermined goals.

LEARNING TO DO IT FASTER
Examples of why training load or speed should decrease:

- Intervals become slower
- Slower recovery daily or between sessions/intervals
- Athlete gets slower at interval training
- Athlete is slower at time trials or specific swim, bike, run
- Athlete’s benchmark WOD’s continue to get slower
- Athlete’s strength continues to deteriorate

Poor technique, fatigue and inability to hit certain WOD performance are all metrics of too much load. Good coaches will not be afraid to pull back work load to allow athletes to get stronger. It is physically impossible to get stronger training—we only get stronger when we rest (HGH is only secreted when we sleep).
6 WEEK HOMEWORK VIDEO LINKS

Week #1 Using Turnover

Week #2

Week #3

Week #4

Week #5 Using Turnover/ Cadence

Week #6 Re-test

Questions?
6 WEEKS OF RUN TECHNIQUE (HOMEWORK)

(You will need a Tempo Trainer or Seiko Metronome) use 60-120 second recoveries between repeats.

---

RUN INTERVALS: WEEK 1: 3X’S PER WEEK

3 Running drills:
- Ball of foot hops with forward lean 3 x 3
- Wall Drill: 3 x 20 on each leg
- Forward Lunge (exaggerated foot pulls on one side) 3 x 10 each

2x’s Through of:
- 4 x 30 sec @ 94-96 cadence
- 1 drill (choice)
- 1 x 2 min @ 91 cadence

---

RUN INTERVALS: WEEK 2: 2-3X’S PER WEEK

3 Running drills:
- Ball of foot hops with forward lean 3 x 10
- Wall Drill: 3 x 20 on each leg
- Forward Lunge (exaggerated foot pulls on one side) 3 x 10 each

2x’s Through of:
- 4 x 1 minute repeats @ 96 cadence
- 1 x 4 minutes @ 91 cadence
RUN INTERVALS: WEEK 3: 2X'S PER WEEK

4 Running drills:
- Stable Arm Drill x 3
- Carioca: 3 x 10 both directions
- Forward Lunge (exaggerated foot pulls on one side) 3 x 10 each
- Wall Drill: 3 x 20 on each leg

1x through of:
- 4 x 1min 30sec repeats @ 98 cadence
- 1 drill (choice)
- 1 x 6 minutes @ 93 cadence

RUN INTERVALS: WEEK 4: 3X'S PER WEEK

3 Running drills:
- Stable Arm Drill
- Carioca: 3 x 10 both directions
- Forward Lunge (exaggerated foot pulls on one side) 3 x 10 each
- Wall Drill: 3 x 20 on each leg

1x through of:
- 4 x 1min 30sec repeats @ 100 cadence
- 1 drill (choice) between
- 1 x 6 minutes @ 94 cadence
RUN INTERVALS: WEEK 5: 2X’S PER WEEK

3 Running drills:

- Stable Arm Drill
- Carioca: 3 x 10 both directions
- Forward Lunge (exaggerated foot pulls on one side) 3 x 10 each
- Wall Drills: 3 x 20 on each leg

1x through of:

- 4 x 1min 30sec repeats @ 101 cadence, rest 2 minutes in between each repeat
- 1 drill (choice) between
- 1 x 6 minutes @ 92-94 cadence (find where you are comfortable)

RUN INTERVALS: WEEK 6: 2X’S PER WEEK

3 Running drills:

- Stable Arm Drill
- Carioca: 3 x 10 both directions
- Forward Lunge (exaggerated foot pulls on one side) 3 x 10 each
- Wall Drills: 3 x 20 on each leg

1x through of:

- 4 x 1min 30sec repeats @ 102 cadence w/ 2 min rest between repeat
- 1 drill (choice) between
- 1 x 6 minutes @ 92-94 cadence (find where you are comfortable)
## TEMPO TRAINER RUNNING CADENCE CHART

<table>
<thead>
<tr>
<th>TT Setting</th>
<th>Cadence</th>
</tr>
</thead>
<tbody>
<tr>
<td>.67</td>
<td>90</td>
</tr>
<tr>
<td>.66</td>
<td>91</td>
</tr>
<tr>
<td>.65</td>
<td>92</td>
</tr>
<tr>
<td>.64</td>
<td>94</td>
</tr>
<tr>
<td>.63</td>
<td>95</td>
</tr>
<tr>
<td>.62</td>
<td>97</td>
</tr>
<tr>
<td>.61</td>
<td>99</td>
</tr>
<tr>
<td>.60</td>
<td>100</td>
</tr>
<tr>
<td>.59</td>
<td>101</td>
</tr>
<tr>
<td>.58</td>
<td>102</td>
</tr>
<tr>
<td>.57</td>
<td>105</td>
</tr>
<tr>
<td>.56</td>
<td>107</td>
</tr>
<tr>
<td>.55</td>
<td>109</td>
</tr>
</tbody>
</table>

Minimum cadence needed to receive the benefits of ground reaction force and muscle elasticity is 90.
RUNNING TECHNIQUE BASIC DRILLS SHEET

DRILLS
Body Weight Awareness Drills "Where your body weight goes you move."
Stand in good posture on balls. Shift BW in different directions until body moves in that
direction Partner version. Stand in good posture and partner pushes athlete in different
directions.

BODY ALIGNMENT DRILLS
Hops (like jump roping). Do correctly and incorrectly. Correct: neutral hips, head on spine,
knees slightly bend, landing on balls without lower leg activation Incorrect: chin forward,
head in front, bent at the hips, on toes, on heels.

POSE/POSTURE DRILLS:
Stand up straight with head on spine line and hips straight. Feet should be shoulder width
with weight on balls. Knees are slightly bent. Figure 4 Pose on left and right (In front of
mirror). Check Posture. 60/60 Do 60 pulls in 60 seconds holding perfect pose on each step.

PULLING DRILLS:
Single Leg Track lift (to figure 4). Pull heel up track of other leg.

CADENCE:
Pull & Fall. 1-2. Pull hamstring of support leg, then let other foot fall Incorrect pulling: foot

FALLING DRILLS:
Hops w/ lean (no bending at waist) Fall into wall or pole from ankles. Release weight from
the ball of the foot. Accelerator Drill – Start running in place by Pulling. Add lean to fall
into forward movement. Pull back up to vertical until running in place again. Repeat fall
and level out several times.

SHARPENING & AWARENESS DRILLS:
Arms in front (straight out) “Charlie’s Angels Drill” No waging or bouncing. Helps with feel-
ing of falling and not over-reaching. Arms in back Helps feeling of falling forward and not
overreaching with the foot in front Two Fingers on Belly Button Centering exercise Focus
on movement of GCM. Not bouncing. Analogy: Model or waitress. Be a Hovercraft.
BEGINNER RUNNING PRACTICES

8 x 200m maintaining form and having no more then 2-3 sec deviation in time. Perform the following:

- Wall Drill + 2 x 200m rec 1 min between each
- Carioca + 2 x 200m rec 1 min between each
- Forward Lunge + 2 x 200m rec 1 min between each
- Stable Arm Drill + 2 x 200m rec 1 min between each

3 x (2 x 400 + 800) rec 1-2 min between 400's and 800

- #1 @ marathon Pace
- #2 @ Half Marathon Pace
- #3 @ 10K pace

3 x (200 + 400 + 600) rest 1- 2 min between each distance

- #1 Slowest
- #2 Second Fastest
- #3 Fastest times of entire set

Overtraining = Not able to maintain desired technique and pace
ADVANCED RUNNING PRACTICES

TABATA INTERVALS ON TREADMILL OR ROAD/TRACK
8 rounds of 20 seconds running + 10 seconds rest at 12% Grade and best 5k Pace. If you cannot hold pace for entire “Tabata” slow it .5 mph. This will be an indication that you are lacking in cardio-respiratory endurance. Running hills will make you not only a stronger runner, but also a faster runner. On a road or track go 20 seconds all out and rest 10 seconds. Then turn around and try and match that distance repeating the process for 8 rounds.

8 X 200M REPEATS
Progression for speed Maintaining form you want to be able to hold the fastest pace possible and have the ability to recover and repeat. You also want the ability to hold or descend each 200, not slow down. This can be used at the end of weekend slowed down by 10-15 sec, followed by a recovery strength set. Recovery: start w/ 90sec progress to 30sec.

4X 400M REPEATS (CAN ADVANCE UP TO 10 X 400M)
Progression for speed Maintaining form you want to be able to hold the fastest pace possible and have the ability to recover and repeat. You also want the ability to hold or descend each 400, not slow down. This can be used at the end of weekend slowed down by 10-15 sec, followed by a recovery strength set. Recovery: Start w/ 3 min progress to 60-45sec.

3 X 800 (CAN ADVANCE UP TO 5 X 800M)
Progression for speed Maintaining form you want to be able to hold the fastest pace possible and have the ability to recover and repeat. You also want the ability to hold or descend each 800, not slow down. This can be used at the end of weekend slowed down by 10-15 sec, followed by a recovery strength set. Recovery: Start w/ 3 min progress to 60sec.

4-5 X 1000M/1K
Progression for speed Maintaining form you want to be able to hold the fastest pace possible and have the ability to recover and repeat. You also want the ability to hold or descend each 1000/1k, not slow down. This can be used at the end of weekend slowed down by 10-15 sec, followed by a recovery strength set. Recovery: Start w/ 3 min progress to 60sec.

2 X 200, 2 X 400, 2 X 1K
Progression for speed Maintaining form you want to be able to hold the fastest pace possible and have the ability to recover and repeat. You also want the ability to hold or descend each 200, then each 400, then each 1k, not slow down. Recovery: Start w/ 3 min progress to 60sec for each set.

5 X 800
Progression for speed Maintaining form you want to be able to hold the fastest pace
possible and have the ability to recover and repeat. You also want the ability to hold or descend each 800, not slow down. This can be used at the end of weekend slowed down by 10-15 sec (no closer then 2 weeks out from a race), followed by a recovery strength set. Recovery: Start w/ 3 min progress to 60sec.
DISTANCE SETS

(instead of long slow distance)

Have the ability to hold or maintain pace. This can apply to road, trail, track, or if needed (not recommended) treadmill. These are advanced sets and if they are set too fast they/you will not recover and will not make the interval. These should not be used until the individual is ready to handle! So all of the prior interval sets have been met.

2 - 3 X 2 MILE
I like to do these mid week, and the same principles apply as the above stated.

Also, keep in mind your cadence and form needs to be maintained for all sets. Recovery: Start w/ 10 min progress to 2min.

2 - 4 X 5K
I like to do these on the weekend, and the same principles apply as the above stated. Also, keep in mind your cadence and form needs to be maintained for all sets. 6-3 weeks out form a race. Followed the next day by one of the other interval sets, and Strength & Conditioning Recovery. Recovery: Start w/ 15 min, progress to 3-5 min.

STRENGTH AND CONDITIONING RECOVERY

This can and should be done the day of races, after long runs, or on Sundays after interval work. Restores the body back to its normal functioning stature post race. Glute Ham Developer Sit-ups (make sure you are extending knees aggressively to come up... your quads should also burn on this) 3 x 15, Glute Ham Developer hip extensions (hamstrings and butt should burn), Kettlebell/Dumbbell swings 3 x 15, Bench Press, Pull-ups All exercises with light - medium weight. 3 sets! Reps are until you feel burn in target area or prescribed amount.
RACE WARM-UP & PACING STRATEGIES

It is important to treat your race much like you were treating your training. Your training should have been serious enough that your diet was built for optimum performance and limited in grains processed foods, if not void of them. You should have gotten the best possible rest and recovery. Along with all of this, you should have warmed up properly before each workout in order to give 100% at each training session. None of this should change come race day!

Warm-up The basic idea of “the shorter the race, the longer the warm-up” is a good concept to go by. If it takes you a while to get going, then a longer warm-up may be necessary for a 5 or 10K. For longer races you should look at the first few miles of your race as a continuation of your warm-up and not start out too hot. When getting into ultra distance events the first few miles should definitely be the warm up. There is no reason intensity in an event that is going to take 6 plus hours should be high at the beginning of an event like these.

For 5k to ½ marathon... Start about 15-30 minutes to race time Run 5-10 minutes EZ to elevate HR and warm muscles. Do 4-8 x 100m pick-ups. Build EZ leg speed without too much effort. These can be done right in front of the starting line with about 5 minutes to race start. This will keep your HR up near where it will be for the race. It will shock your system if you are standing around for 10 minutes before the race with a little to no exertion, only to ramp it up to almost max effort immediately.

Get your system ready to go hard by elevating exertion levels before race start so that once you begin it isn’t a shock.
RACE STRATEGIES TO HIT YOUR GOAL TIME
Choose a goal time that is reasonable for you to achieve on that particular course and time of season. Input your PR in a recent time trial into the McMillan Run Calculator (Google it) for an accurate display of where you should finish. Be prepared to modify the goal time if conditions are tougher than usual, you are dealing with sickness, or some other issue that may affect peak performance. The goal should be to run the best possible race you can for THAT day, which means it might not necessarily be a PR for you to be happy with it.

ADDITIONAL TIPS
Try to get your mile splits on your watch. If you wear a watch that has lap times on it (highly recommended) you can hit splits at each mile marker. This allows you to see where you are in terms of time. Knowing if you've been 5 seconds fast or 10 seconds slow each of the last 3 miles still gives you a parameter for actual race time (plus or minus). Remember this is an endurance event (ENDURE!) not Fran. You will suffer the consequences of too fast a start if you don't watch it.

Evaluating the data after the race will help you set goals and racing strategies for your next event.

Here is a link to a Running Pace Chart to help you figure things out.
RUNNING TECHNIQUE SHEET

Name: ___________________________ Date: ________________

Scoring: 0-10 (0=Not at all, 10=Perfect)

POSTURE
________ Neutral Head Position _______ Straight “Pillar”
________ Slightly leaning forward _______ Relaxed shoulders
________ Elbow bent more than 90 degrees _______ Relaxed face

RHYTHM & TIMING
________ Arms swing front to back _______ 90+ cadence
________ Floating head (not bouncing)

TECHNIQUE
________ Heels lift straight up toward butt _______ Figure 4 position (“Pose”)
________ Landing midfoot directly beneath knee

ERRORS
________ Knees straightened Feet on ground for too long
________ Shopping Cart Position (Bending at waist)
________ Over pulling (heel too close to butt)
________ Under-pulling (not high enough)
________ Pushing (over extending the leg in back)
________ Pronation _______ Supination _______ Loud feet

COMMENTS:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
CROSSFIT ENDURANCE WARM-UP

1. Complete 15 push-ups. Each repetition should be completed using a different hand position full range of motion.

2. Alternating Plank Lunge. Get into a plank position and bring your right foot to the outside of your right hand; press hips forward and keep the back leg as straight as possible. Repeat with your left side.

Figure 9.
3. Alternating Open Chest Plank Lunge. Repeat the steps for Plank Lunge, but after placing your leg next to your hand bring your hands behind your head and open up the chest like you are performing a lunge from a standing position. Focus on pressing hips forward and keeping back leg straight.
4. **Plank Lunge to Perfect Squat.** Repeat the steps for Plank Lunge after placing your right leg next to your right hand, bring your left leg next to your left hand. Push your knees out, and perform a perfect squat from the bottom squat position. Walk your hands out to plank and repeat.

![Figure 11](image)
5. Walking Downward Dog: Get into a downward dog position. Keeping your legs as straight as possible and maintaining a lumbar curve arched (a lack of flexibility will make this difficult), drive your heels into the ground and begin walking forward and then backward. Focus on keeping the legs straight and heels on the ground; tight calves and/or tight hamstrings will definitely be felt!

Figure 12.
FOOT EXERCISES

The foot exercises include lateral to BOF (Ball of Foot) ankle rotations, medial to BOF ankle rotations, internal rotation of the feet stretch, external rotation of the feet stretch.

Figure 13.
Another foot exercise can be described as follows: place the right heel at the edge of the right edge of the left foot; keeping the right leg straight and bending the left leg, lean into the right leg as you feel the stretch pulling your right toe up if flexibility permits. Repeat with the left side.

Figure 14.

Next, place the right heel on top of the left foot and rock back and forth moving from heel on the left with an active, dorsiflexed foot, to BOF on the left applying pressure down with the right. Repeat with the other side.

Figure 15.
Finally, staying on the BOF on your right, take your left foot and reach across as though you are picking up marbles or pieces of string. Repeat with the left. This will burn out the planted foot.

Figure 16.
CROSSFIT ENDURANCE RUNNING DRILLS

BALL OF FOOT—(BOF)
is also referred to as the mid foot. It is the area forward of the arch, before the toes and it is where we land while running. Stand with upright, correct posture. Feet are shoulder width apart, knees are soft. Midline is tight with neutral hips. Head is on spine line (chin is not jutted out in front) and vision is forward. Arms are at 90 degree angle and shoulders are back and relaxed. Start hopping in place while holding posture 10-20 hops. Add a lean forward from the ankles and hop forward for 10 hops. Repeat 3x.

WHY?
This is an important drill as it teaches the client where to land while running as well as how to fall forward while maintaining tight midline.

COMMON MISTAKES
Landing too far forward on the foot (toe running). Not letting the heel “kiss the ground” while on BOF. Staring at the ground or leaning too far forward.

FIXING THE MISTAKES
Returning client to perfect posture and find the ball of foot.

Figure 17.
POSTURE DRILL
Stand up straight with head on spine line and hips straight. Abdominals are contracted and tight. Feet should be shoulder width with body weight on the ball of foot. Lift one leg off ground and pull up under the glutes, standing leg has body weight on ball of foot. Figure 4. Arms are at 90 degree angle, shoulders are relaxed and chest is out.

WHY?
Learning the correct posture will minimize the common running injuries as well as make the client a more efficient runner.

COMMON MISTAKES
Jutting the neck out in front of the spine line or holding chin up (looking up). Shrugging shoulders or rounding shoulders forward. Lifting knees up too high in front (using the hip flexors), or letting the foot trail out behind.

FIXING THE MISTAKES
Going over correct posture, as well as introducing the other drills will generally correct the failure to find the Figure 4 position. Maintaining a tight midline is crucial as well.

Figure 18.
WALL DRILLS

LEAN INTO WALL
Stand with straight posture and stable midline. Shoulders are relaxed and back while holding hips neutral. Extend arms straight out and fall forward into the wall maintaining rigid body. Keep vision straight and don’t look down at the ground. Run in place, pulling feet off the ground in the Figure 4.

BACK TO WALL
Stand with back and feet a few inches out from the wall. Posture is straight and weight is on ball of foot. Pull the right foot off the ground using the hamstring to the Figure 4 posture, and return to BOF. Any push off with the foot instead of lifting will result in hitting the wall behind. Perform 20 pulls with each foot.

WHY?
These drills teach how to fall into forward movement, holding the Figure 4 posture. As well as how to pull the foot off the ground using the hamstring without pushing off to gain distance.

COMMON MISTAKES
Breaking at the hips (butt back, chest dipped forward), pulling knees too high up, pulling foot too high, letting foot trail out behind you (not under your butt). Help client find correct position by placing a hand at their knee level and also where their foot should be pulling up.
**STABLE ARM FALL**  
(aka Gun Drill) – Stand in correct posture, hips neutral, knees slightly bent and feet shoulder width apart. Shoulders are relaxed and back. Vision is forward. Extend arms out in front of body and clasp hands while keeping arms locked out. Begin running in place by pulling feet off the ground in Figure 4 posture, maintaining locked out arms and tight midline (no breaking at the waist). Fall forward at the ankles and run while keeping arms from shifting side to side. Keep eyes forward on target straight ahead. Standing knee stays slightly bent.

**ARMS BEHIND BACK**  
similar drill to Stable arms, but arms are in locked out position behind the back.

**WHY?**  
These drills help with the feeling of falling forward and maintaining midline stabilization without breaking at the hip.

**COMMON MISTAKES**  
Breaking at the hip, high knees, foot trailing out behind general center of mass, or keeping knees low as well as doing “butt kickers” instead of pulling foot up under butt.
PARTNER FALL
Runner #1 stands in Figure 4 Posture while Runner #2 supports their body weight at the shoulders, keeping them from falling. Runner #1 runs in place by pulling their feet off the ground, vision is forward. Once Runner #2 feels their commitment to the lean he lets go, and Runner #1 continues with a test run, holding form.

WHY?
This drill gets the client comfortable with the degree of lean needed to obtain forward movement.

COMMON MISTAKES
Runner #1 has too severe of a lean or failure to hold correct posture by breaking at the hip.

CORRECTING MISTAKES
Return client to perfect posture holding their weight on balls of feet. While holding this tight posture, with hips neutral (no breaking) have them lean all their weight into your hands as you support their weight. Gaze should be straight ahead. As client runs in place feel their commitment to the lean. If you can push them backwards, they are not leaning enough. Let go of runner, letting them do a test run when lean has been obtained.

CARIOCA
Client stands with arms stretched out to sides with weight balanced on balls of feet. While leaning in one direction criss – cross the legs in front and back while moving in the direction of the lean. Repeat in opposite direction. Maintain tight midline, shoulders are relaxed.

WHY?
This drill enforces in the client to work with gravity to cause movement. Where your lean is, your body will go. Also teaches client to stay on ball of foot.

COMMON MISTAKES
Leaning at your arms instead of leaning with entire body. Failure to maintain tight midline or leaning too much. It should be a slight lean.

CORRECTING MISTAKES
Have client stand with perfect posture, midline tight and weight on balls of feet. Remind them to lean from the hip, instead of reaching with arms.
JUMP ROPE DRILL
With a jump rope stand in perfect posture with weight on balls of feet. Holding the midline tight, begin jumping rope and land softly on balls of feet. You do NOT want to heel strike while jumping rope, so maintain ball of foot landing. Begin alternating feet to simulate running in place. Add a forward lean from hips and begin running forward while jumping rope. Have client level out and jump in place for reps, then add the forward lean for reps and repeat.

WHY?
This drill teaches the client to stay on ball of foot while running, and how to lean from the ankles to obtain forward movement. Have client do a few jumps while landing on their heels then perform a few jumps landing on ball of foot. Equate this drill to the heel strike. You wouldn’t land on your heels while jumping rope. Same holds true for running.

COMMON MISTAKES
Lifting the knees up too high (hip flexor running), kicking foot up too high behind or trailing foot out away from under glutes. Landing too far out in front of general center of mass, and heel striking.
EXAGGERATED FORWARD LUNGE
Stand in perfect posture on balls of feet with shoulders relaxed and arms at 90 degrees. While holding midline tight, exaggerate pulling one foot off the ground to figure 4 position while falling forward at the ankle. Perform 10 pulls on the right, then 10 pulls on the left while moving slowly forward. Over emphasis of the pull should be a “snap” and be felt in the hamstring of the active leg. Keep ankle relaxed and do not dorsi flex. As a drill, this is not meant to be performed quickly or to cover much ground.

WHY?
This drill is for teaching client to keep the ankle relaxed while running, preventing heel striking. Also to feel the snap of the hamstring generated by the pull off the ground.

COMMON MISTAKES
The hardest thing for most clients to do is stay relaxed at the ankle. This drill requires a little coordination, slowing client down and pulling in place before adding the lean helps.

CORRECTING MISTAKES
Have client perform drill while following behind them, helping them pull their foot off the ground with your hand.

Figure 22.