CROSSFIT ENDURANCE

Running Mechanics & Performance

CFE/LSD Progression Hierarchy

LSD Hierarchy	CFE Hierarchy
Volume 1	1 Technique/Skill
Intensity 2	2 Intensity
Technique/Skill 3	3 Volume

LSD 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.

1Munro et al., 1987; Weyland et al., 2000
2Hunter et al., 2005
3Elliot & Banksby, 1979
4Brandell 1973; Mann and Hagy 1980, Pare et al., 1981, Schwab et al., 1983, Nilsson and Thorstensson, 1985, Montgomery et al., 1994

The Concept of Efficient Running

- Movement is built on an infinite number of positions, through which the body moves in space and time.
  - The dead lift, 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 the ideal pose 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 starting position (in our case, pose)
Establish appropriate fall for speed desired.
Define the finish position (pose on other leg)
Define the easiest way to move from start to finish (pose, fall, pull)

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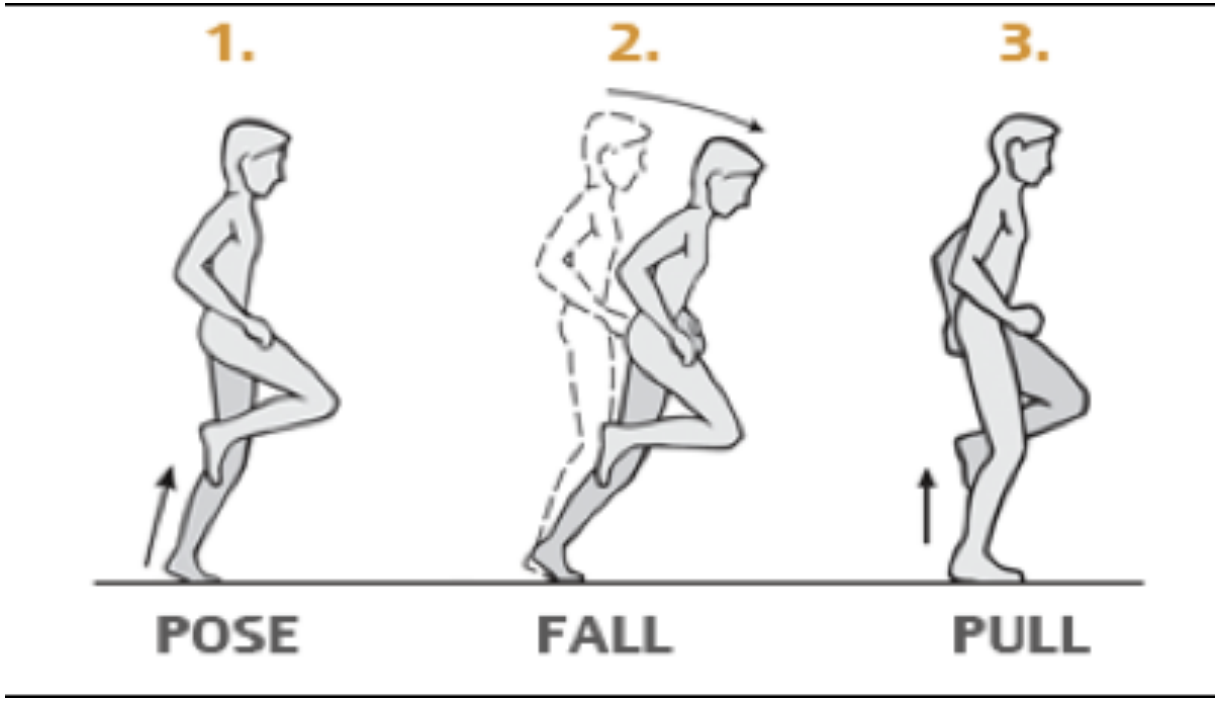
Pose- Fall- Pull



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 1
Ground reaction 2
Muscle elasticity 3
Muscle contraction 4
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….

1.Graham-Brown, 1912, 2 Cavagna & Lafortune, 1980, 3 Cavagna et al, 1964, 4 Heise et al, 1996

Gravity

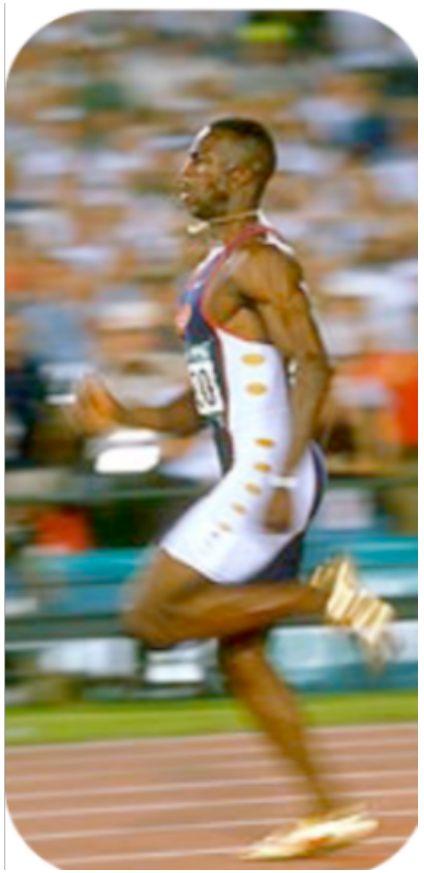
- The strongest mechanical force among the forces in nature Anokhin stated, “all biological systems, the most essential characteristics of it, are defined by the Universal Law of Gravity.” 1
- Leonardo Da Vinci was the 1st to recognize gravity as a propulsive force, when he stated, “motion is created 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” 1
- 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) 2

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.

1 Keele, 1983: p. 173; , 2 Fen, 1930

Position

- All movement begins & ends with a specific position.
- Requires accuracy, agility, balance, and coordination, therefore it is a skill.
- Pose is the position from which falling begins.



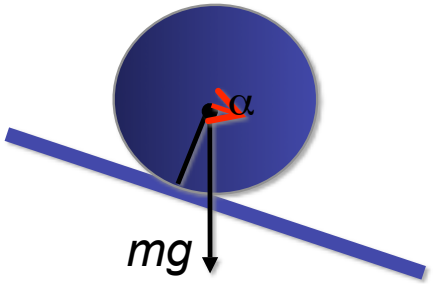
Optimal position= one knee bent to create a figure “4” position; head position neutral; bent support knee; “quiet” upper body shoulders externally rotated.

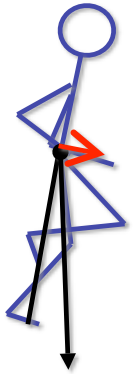
Fall: Rotation around point of support

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)

$$F = mg \times \sin \alpha$$





Much like our PVC example, our pose must be solid from foot to shoulder. Once our pose 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.

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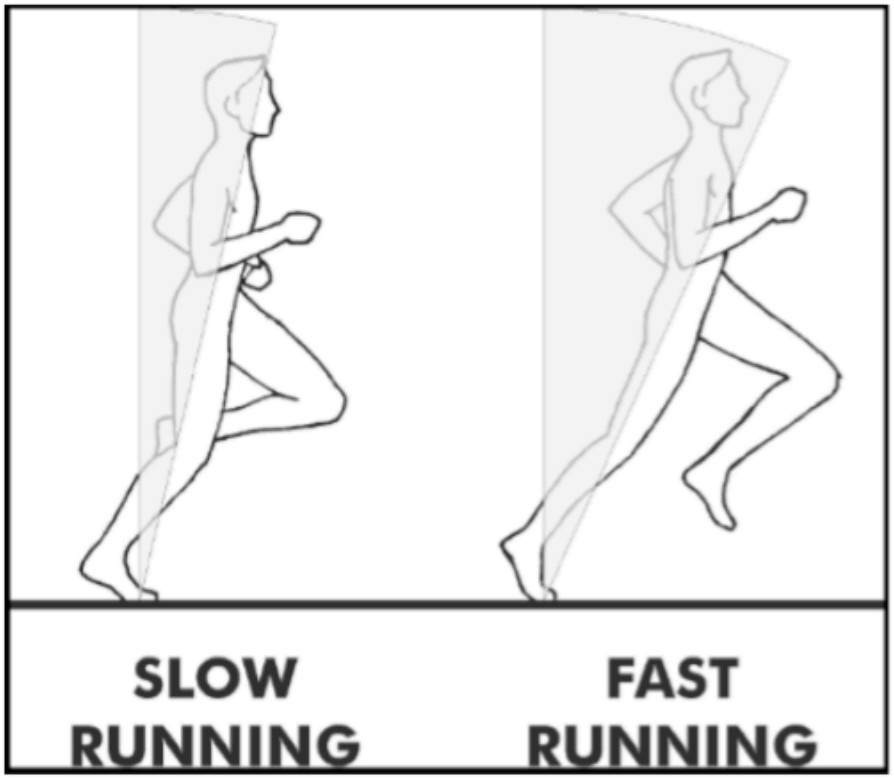
Falling

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.

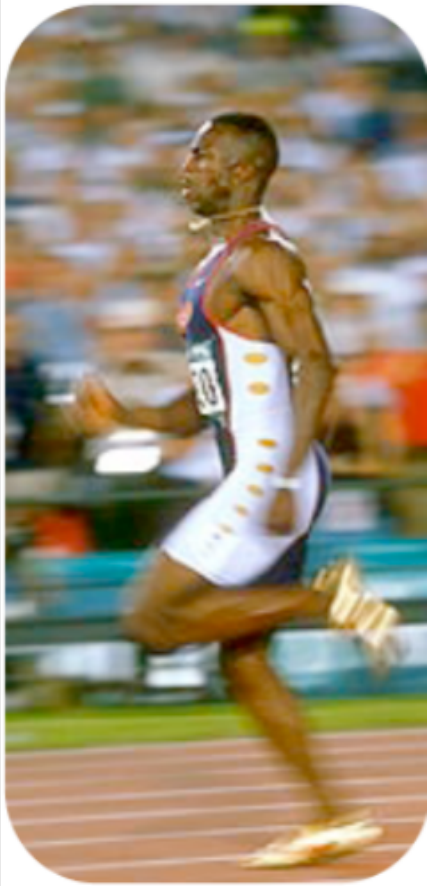
Angles of Falling: More Fall - More Speed



- 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.
Pose never changes, however, degree of fall does…
More fall= more speed.

Variations of Correct Running



A 19.1 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.

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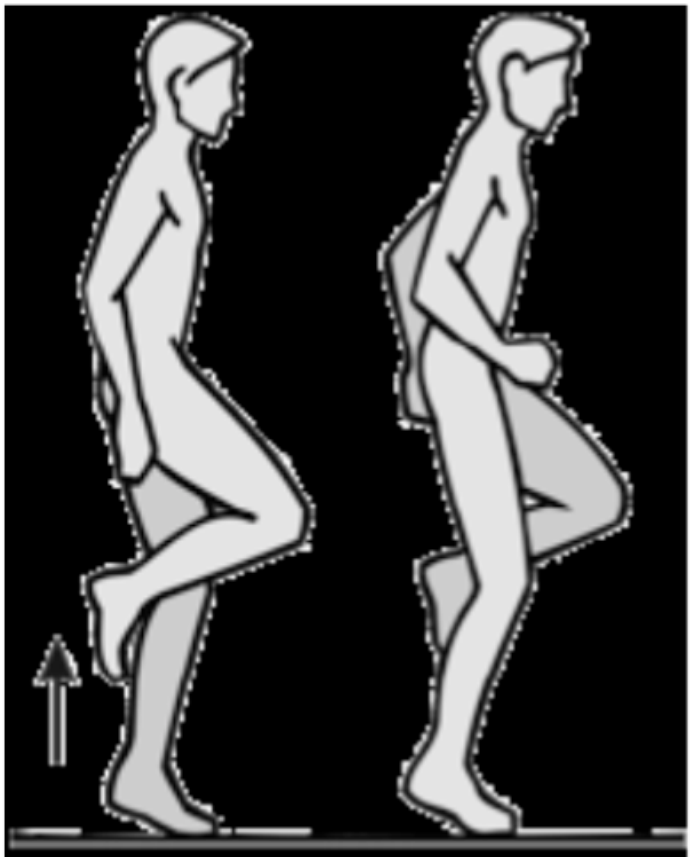
PULL: with hamstrings for change of support

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



A forefoot ground strike will capitalize 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 (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 position (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

- Position- retain midline stability
  - Midline stability: The midline is the entire spine. 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 pose, 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

This quick list of basics reinforces what to do in order to maximize efficiency and speed.

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Fueling the Endurance Athlete

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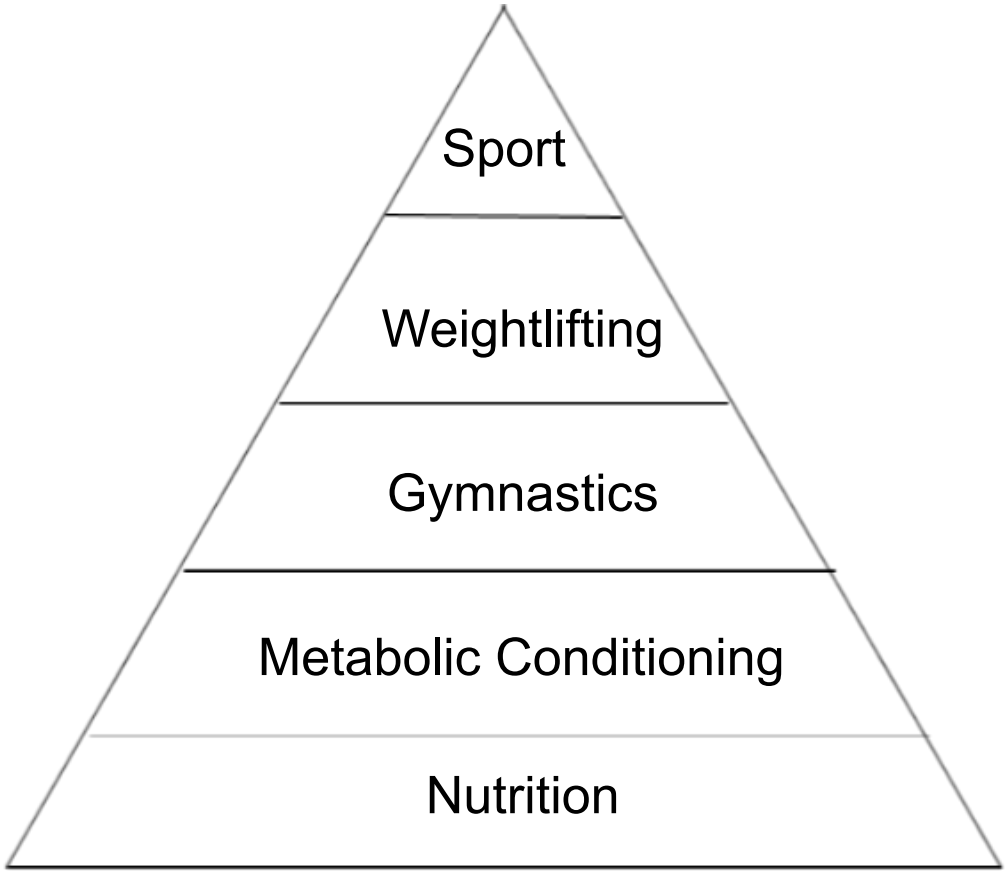
Nutrition



Fueling is a skill that 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.

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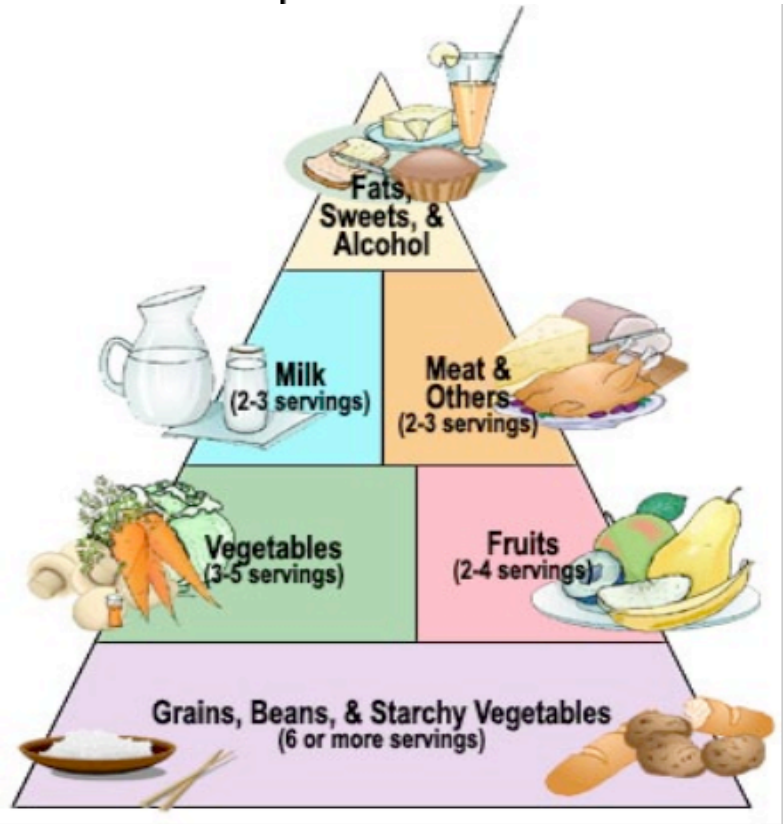
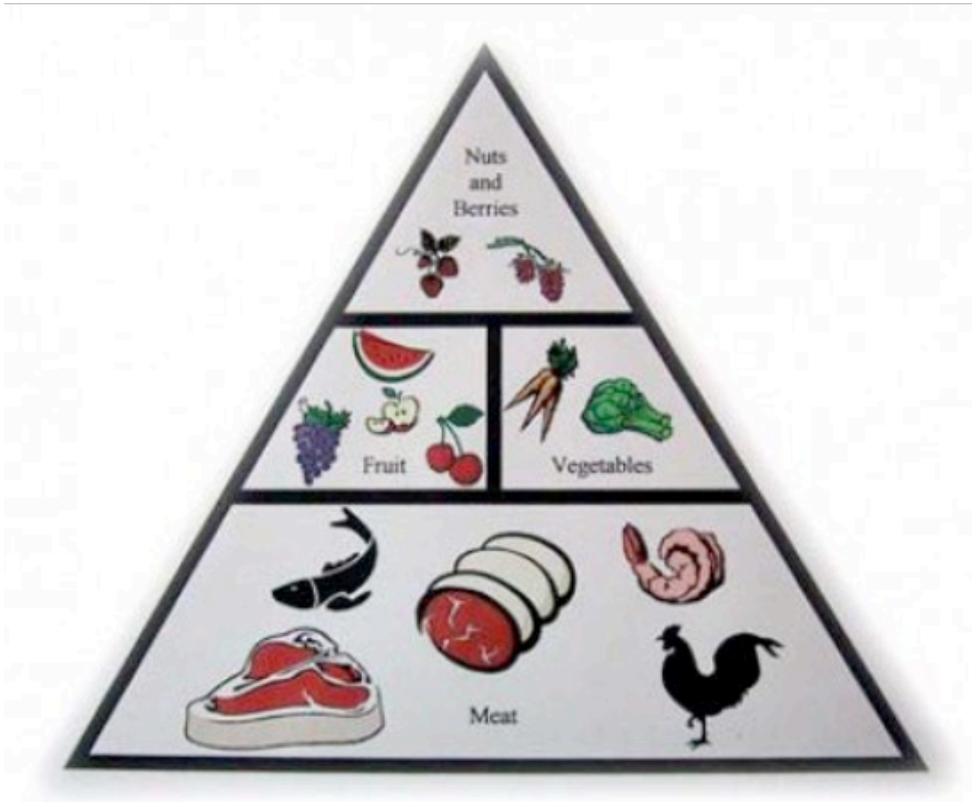
What Do We Eat?





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?

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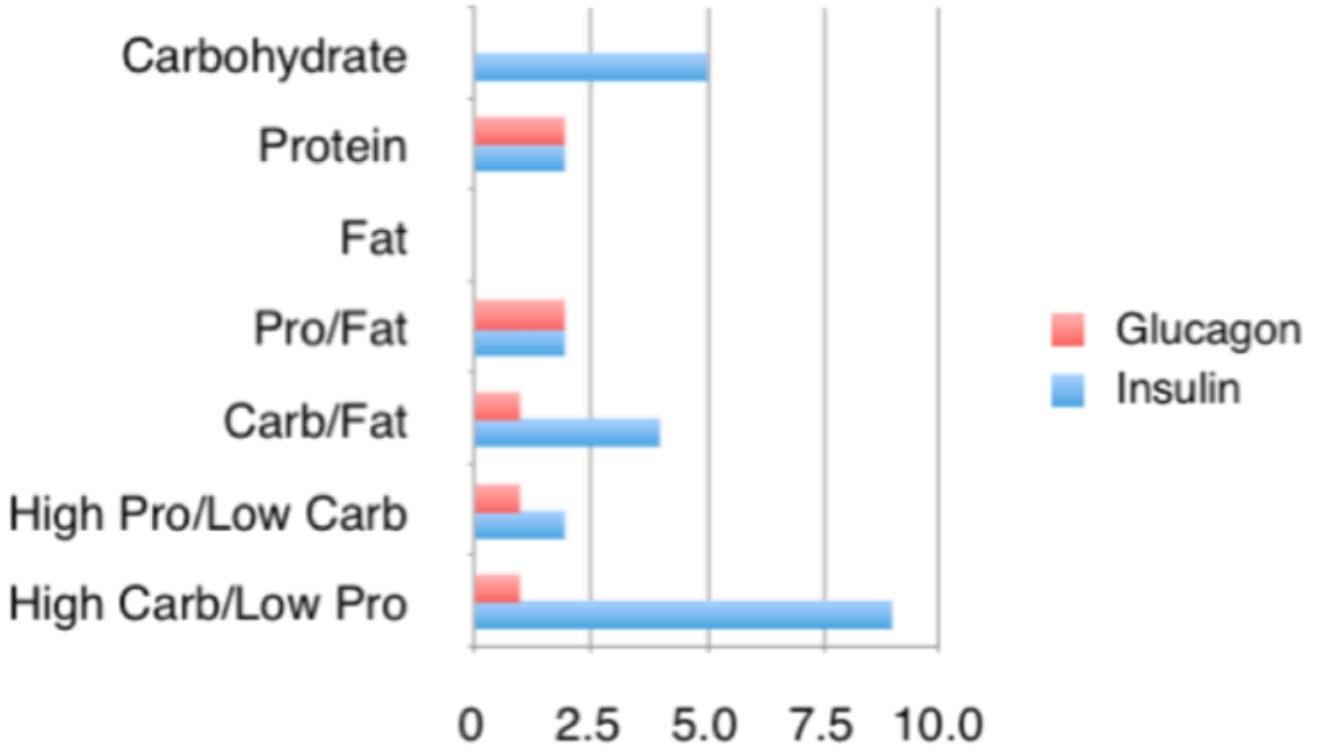
Hormones and Response to Energy



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)

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 w/ 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 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.

The Paleo Diet for Athletes, Cordain, 2005

Nutrition Fueling Protocol

4 Hours+

- Intensity trends lower
- 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 the 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.

The Paleo Diet for Athletes, Cordain, 2005

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 www.gssiweb.com/FluidLoss.aspx
- With a 3% loss of water dehydration occurs.

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 oz of 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 Guidelines

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

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

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.

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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. <u>If there is no standard then there is no error in technique.</u>
- 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)*

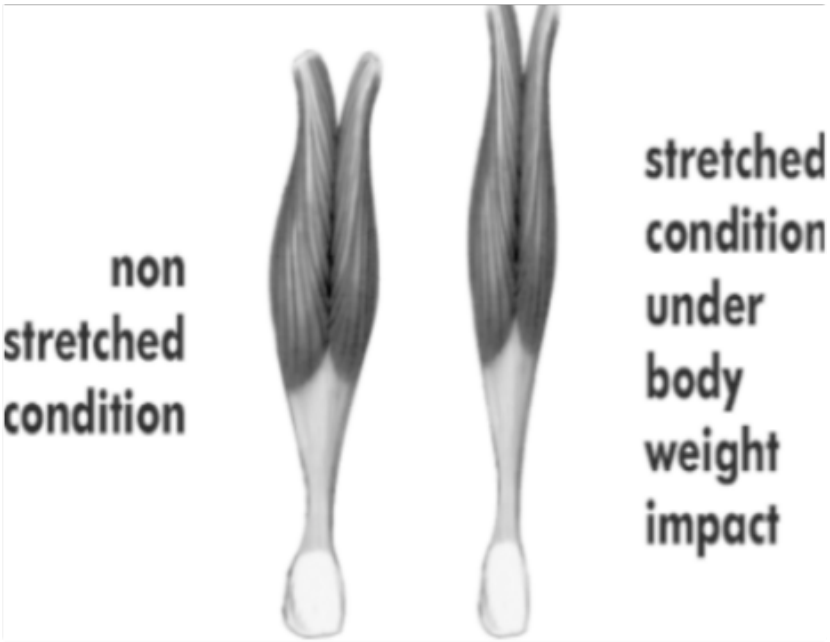
Two Major Rules Which Cause Injuries

- 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 position (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 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

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
- Inadequate warm up
- Over use or training
- Hill running
- Uneven surfaces
- Bad stretching habits

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 this injury from occurring.

Plantar Fasciitis

Cause

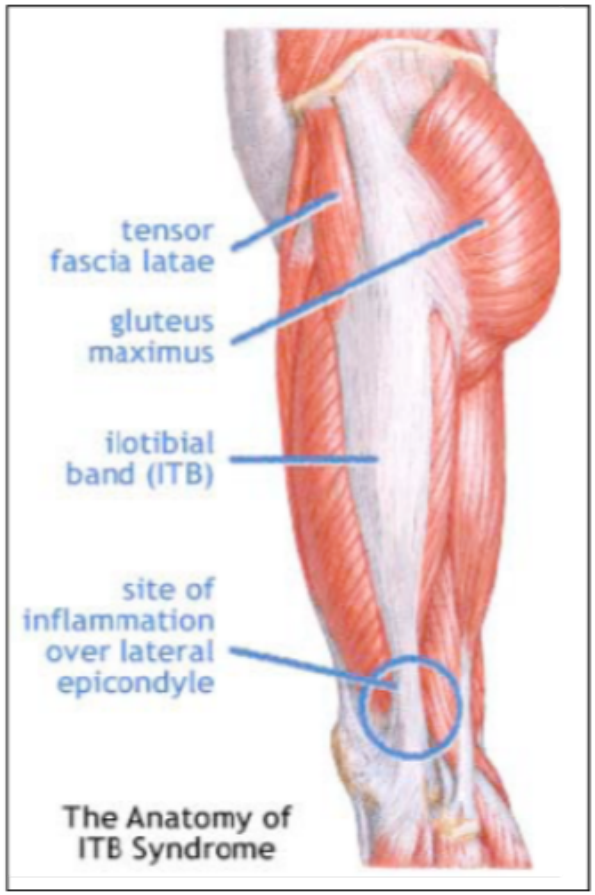
- Too much load on the plantar fascia which leads to tissue breakdown

Why

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

Too much load on a weak fascia will create breakdown. To solve plantar fasciitis over the long term correct technique issues, foot mobility, and strengthen weak facia.

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

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.

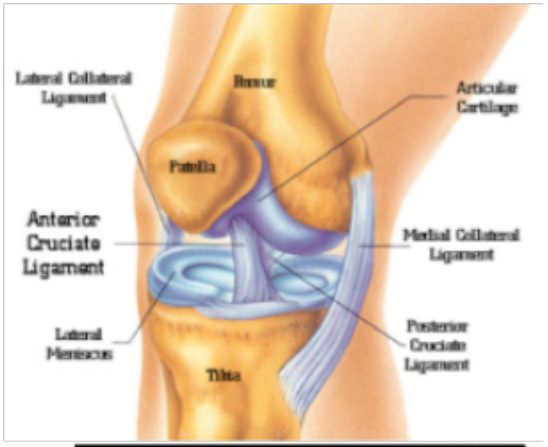
Patellar – Femoral Dysfunction and Patellar Tendonitis

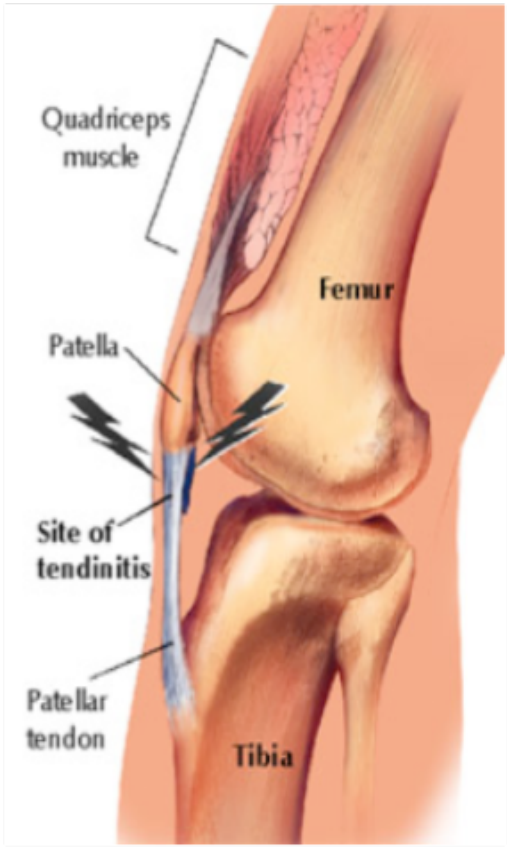
Causes

- 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.

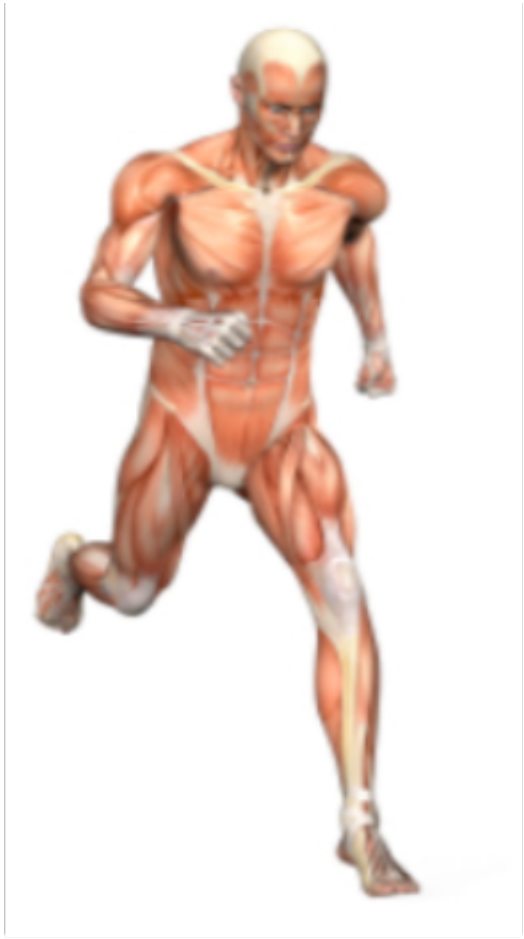
Low Back Pain

Description of Pain

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

Why

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



Heel striking is the primary source of lower back pain. Such pain can 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.
- www.mobilitywod.com Starrett Movement & Mobility

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.

Self Myofascial Release (SMR)

- Fascia
  -- Connective tissue surrounding muscles, bones and joints
- 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
- Foam rollers, lacrosse balls, massage stick, rumble rollers, etc.

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.

SMR Key Area

Foam Roller

- Lower leg(front/back)
- Hamstring (insertion)
- Quadriceps
- Adductors
- IT Band/lateral hip
- Hip external rotators
- Lumbar spine
- Thoracic spine

Lacrosse Ball

-Plantar foot
-Calf
-Hamstrings
-Quadriceps
-ITBand/lateral hip
-Hip external rotators
-2Balls taped together
-Spinal erectors

How to SMR videos and workshops
http://smr.networkfitness.com/smr-categories/

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LSD vs. CFE vs. CF

Long Slow Distance

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

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)

Endurance Case Study

Endurance Case Study:

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 levels

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

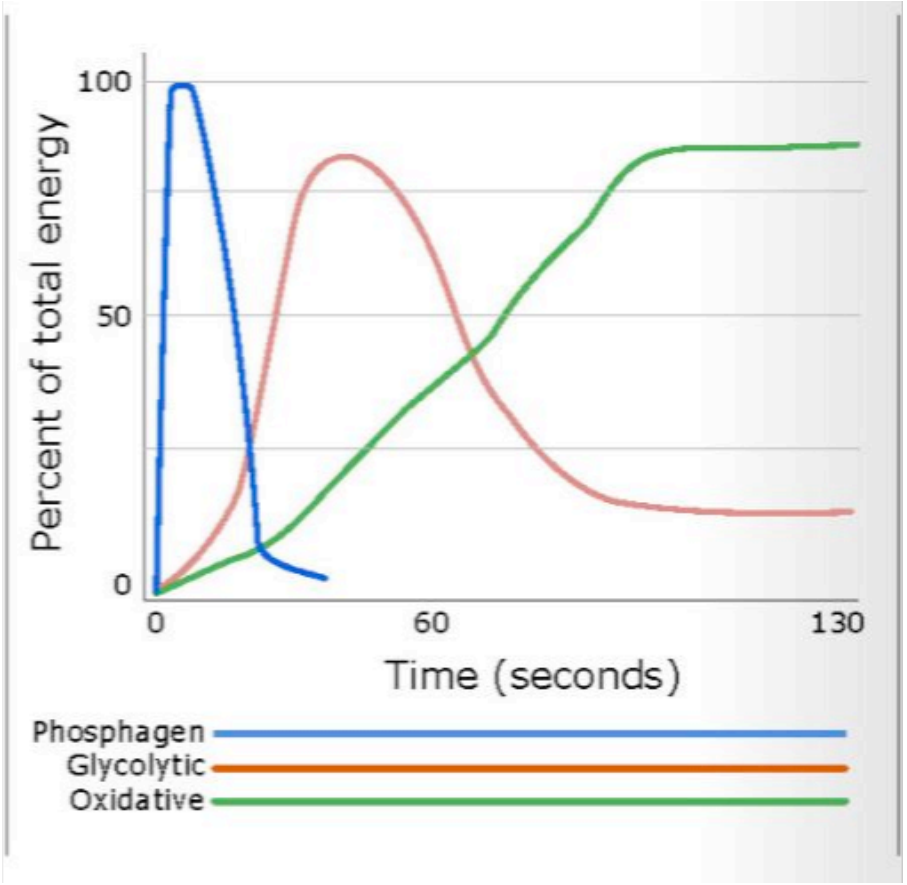
- Increased cardiovascular function
- Decreased body fat
- Increased muscle mass
- Increased strength
- Increased power
- Increased speed
- Increased aerobic capacity
- Greater capillarization
- Increased mitochondrial growth

Drawbacks

- Might require an aerobic foundation depending on sport

Contrary to public belief, anaerobic training expands aerobic capacity as well as increases and fuels muscular endurance activity.

Energy Systems



Pending the activity/sport all of the energy pathways are frequently utilized. Traditional LSD protocols tend to ignore phosphagen, glycolytic and lactic pathway development.

Aerobic Training – A Review

LSD Hierarchy	CFE Hierarchy
Volume 1	1 Technique/Skill
Intensity 2	2 Intensity
Technique/Skill 3	3 Volume

LSD 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.

Technique

Work on Basic Motor Skills for the sport

Running
- Body position
- Mechanics
- Turnover/Cadence

Cycling
- Biomechanics/Bike Fit
- Gear Size/Gear Ratio
- Cadence/RPM

Swimming
- Midline Stabilization
- Stroke Rate
- Breathing

Time only allows for running technique work. Cycling efficiency can be sourced through a quality bike fit and good “pedal thoughts”. Swimming is the most technical discipline and merits the engagement of a professional coach in a 1:1 environment.

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.

Tabata Protocol (13.8% increase in VO2 over 6 weeks)

Anaerobic Backed Up

- www.zone5endurance.com
- Lydiard A, Running to the Top, Meyers and Meyers Sport, 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 capacity in humans J Appl Physiol 98: 1985-1990, 2005
- Coyle, E. Very intense exercise-training is extremely potent and time efficient: a reminder J Appl Physiol 98: 1983-1984, 2005
- Runners Train Less and Be Faster: www.sciencedaily.com/releases/

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

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(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 all of our 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
  - 1-1-1-1-1-1-1 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)

CrossFit

Table 2 - Exercises by Modality

Gymnastics	Metabolic Conditioning	Weightlifting
Air Squat	Run	Deadlifts
Pull-up	Bike	Cleans
Push-up	Row	Presses
Dip	Jump Rope	Snatch
Handstand Push-up		Clean and Jerk
Rope Climb		Medicine Ball Drills
Muscle-Up		Kettlebell Swing
Press to Handstand		
Back Extension		
Sit-up		
Jumps		
Lunges		

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

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CrossFit

Table 3 - Workout Structure

Days	Single-Element Days (1, 5, 9)	Two-Element Days (2, 6, 10)	Three-Element Days (3, 7, 11)
Priority	Element Priority	Task Priority	Time Priority
Structure (set structure)	M: Single Effort G: Single Skill W: Single Lift	Couplet repeated 3-5 times for time	Triplet repeated for 20 minutes for rotations
(intensity)	M: Long, Slow Distance G: High Skill W: Heavy	Two moderately to intensely challenging elements	Three lightly to moderately challenging elements
Work Recovery Character	Recovery not a limiting factor	Work/rest interval management critical	Work/rest interval marginal factor

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.

CrossFit

3 days on, 1 day off

Day	1	2	3	4	5	6	7	8	9	10	11	12
	M	G W	M G W	OFF	G	W M	G W M	OFF	W	M G	W M G	OFF

5 days on, 2 days off

Day	1	2	3	4	5	6	7
wk 1	M	G W	M G W	M G	W	OFF	OFF
wk 2	G	W M	G W M	G W	M	OFF	OFF
wk 3	W	M G	W M G	W M	G	OFF	OFF

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.

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Legend / Key

G	Gymnastics
M	Monostructural
W	Weightlifiting
SI	Short Interval
LI	Long Interval
T/TT	Tempo or Time Trial
S	Swim
B	Bike
R	Run
SS	Single Sport
3S	3 Sports
ME:	Max Effort
DE:	Dynamic Effort

Traditional CrossFit Endurance

Traditional CrossFit Endurance Program 3:1 CF							
Day	1	2	3	4	5	6	7
CrossFit	M	GW	MGW		G	WM	GWM
	(see Endurance)						
Endurance	SI			T/TT		LI	
SS							
Day	1	2	3	4	5	6	7
CrossFit		W	MG	WMG		M	GW
						(see Endurance)	
Endurance	SI		LI			T/TT	
SS							
Traditional CrossFit Endurance Program Triathlete/3 Sport							
Day	1	2	3	4	5	6	7
CrossFit	M	GW	MGW	G			
	(see Endurance)						
Endurance	SIS	SIR		LIB	LIS	T/TT B	T/TT R
3S							
Day	1	2	3	4	5	6	7
CrossFit	WM	GWM	W	MG			
Endurance	SIB	LIR	LIS		SIR	T/TT S	T/TT B
3S							

CFE Linear Strength Bias

Traditional Linear Strength Bias CrossFit Endurance Program

Day	1	2	3	4	5	6	7
Strength	Squat 5 x 5		Deadlift 5 x 5		Press 5 x 5	OFF	
CrossFit		MG	MGW	GW	M	OFF	
					see endurance		
Endurance		SI			LI	OFF	T/TT
SS							
Day	1	2	3	4	5	6	7
Strength	Squat 5 x 5		Deadlift 5 x 5		Press 5 x 5	OFF	
	add 5lbs		add 5lbs		add 5lbs		
CrossFit	G	GW	GWM	WM		OFF	
Endurance		SI		LI		OFF	T/TT
SS							
			3 Sport				
Day	1	2	3	4	5	6	7
Strength	Squat 5 x 5		Deadlift 5 x 5		Press 5 x 5		
CrossFit		MG	MGW	GW	M		
Endurance	SIS	SIR		LIB	LIS	T/TT B	T/TT R
3S							
Day	1	2	3	4	5	6	7
Strength	Squat 5 x 5		Deadlift 5 x 5		Press 5 x 5		
	add 5lbs		add 5lbs		add 5lbs		
CrossFit	G	GW	GWM	WM			
Endurance	SIB	LIR		SIS	LIB	T/TT R	T/TT S
3S							

CFE/Conjugate Strength Bias

Conjugate 3 Day Strength Bias CrossFit Endurance Program							
Day	1	2	3	4	5	6	7
Strength	ME: Squat		ME: Press		DE: Box Squat	OFF	
CrossFit		MG	MGW	GW	M	OFF	
					see endurance		
Endurance		SI			LI	OFF	T/TT
SS							
Day	1	2	3	4	5	6	7
Strength	DE:		ME:		ME: Chin Ups	OFF	
	Bench Press		Good Morning				
CrossFit	G	GW	GWM	WM		OFF	
Endurance		SI		LI		OFF	T/TT
SS							
			3 Sport				
Day	1	2	3	4	5	6	7
Strength	ME: Squat		ME: Press		DE: Box Squat		
CrossFit		MG	MGW	GW	M		
Endurance	SIS	SIR		LIB	LIS	T/TT B	T/TT R
3S							
Day	1	2	3	4	5	6	7
Strength	DE:		ME:		ME: Chin Ups		
	Bench Press		Good Morning				
CrossFit	G	GW	GWM	WM			
Endurance	SIB	LIR	SIS		LIB	T/TT R	T/TT S
3S							

Single Sport Endurance

- One Short Interval
- One Long Interval
- One Tempo/TT (based on week programming)

3 Sport Endurance

- For 1 or 2 sports: One Short Interval and One Long Interval WOD
- The number of sports will depend on the number of tempo/tt wods performed that week. Tempo vs TT will depend on the week schedule.

- For the other sport(s). One Interval and One Tempo/TT WOD
- The number of sports will depend on the number of tempo/tt wods performed that week. Tempo vs TT will depend on the week schedule
- Rotate the sport(s) of tempo/tt wod(s) by week.

Single Sport Taper Protocol

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
				CF		25-40 mins of sport 70% effort
3-3-3-3-3 Back Squat @ 70% of 5x3 rep max	< 10 min CF WOD (moderate) 3 hours before or after. 8 x 200m w/ 2 min rest at 70%	OFF	20 min easy or 80% Tabata for sport	OFF	Raceday	CFE Strength and Recovery

Unlike traditional LSD tapers, the CF/CFE oxidative pathway is not severely damaged, so 2-3 week tapers are not needed. Tapers are very personal, but this model should provide a very good model to follow. If your athlete feels any fatigue or lethargy, send them home.

Triathlon Taper Protocol

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
					Run AM CF PM	20 mins of each discipline at 70% effort
heavy lift 3-3-3-3-3 Back Squat @ 70% of 5x3 rep max	swim a.m. CF p.m. Helen @ 70% effort	OFF	Brick: run/bike Run 800m Bike 3-5 miles @ race pace	OFF	Raceday	CFE Strength and Recovery

The triathlon taper is virtually identical with only minor changes on Sunday/Thursday before race day

Strength & Conditioning Recovery

- 3X 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)
- 3X 15 Kettlebell/Dumbbell Swings 3 x 15 Bench Press 3X15 Pull Ups

All exercises are done 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 http://www.mcmillanrunning.com/mcmillanrunningcalculator.htm 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 <u>decrease</u>

- Intervals become slower
- Slower recovery
- 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)

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