techniques

for Track & Field and Cross Country

VOLUME 14, NUMBER 2
NOVEMBER 2020

HIGH-JUMP MICROCYCLES

TRAINING ELITE FEMALE HIGH JUMPERS

PLUS

RED-S: BREAKING MYTHS AROUND WEIGHT AND PERFORMANCE

TACTICAL DEVELOPMENT MECHANISMS FOR DISTANCE COACHES

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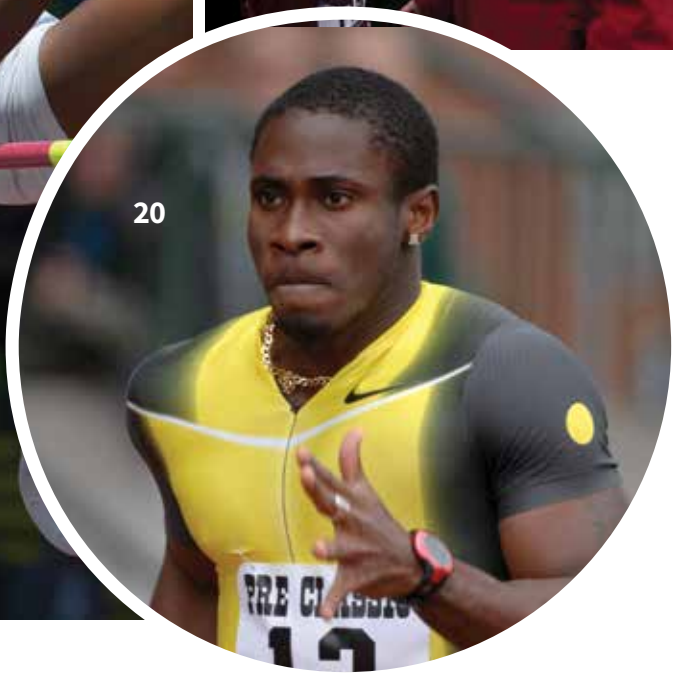

ON THE COVER: LOGAN BOSS OF MISSISSIPPI STATE PLACED THIRD IN THE HIGH JUMP AT 6'0" (1.87M) AT THE 2018 NCAA INDOOR TRACK & FIELD CHAMPIONSHIP MEET.

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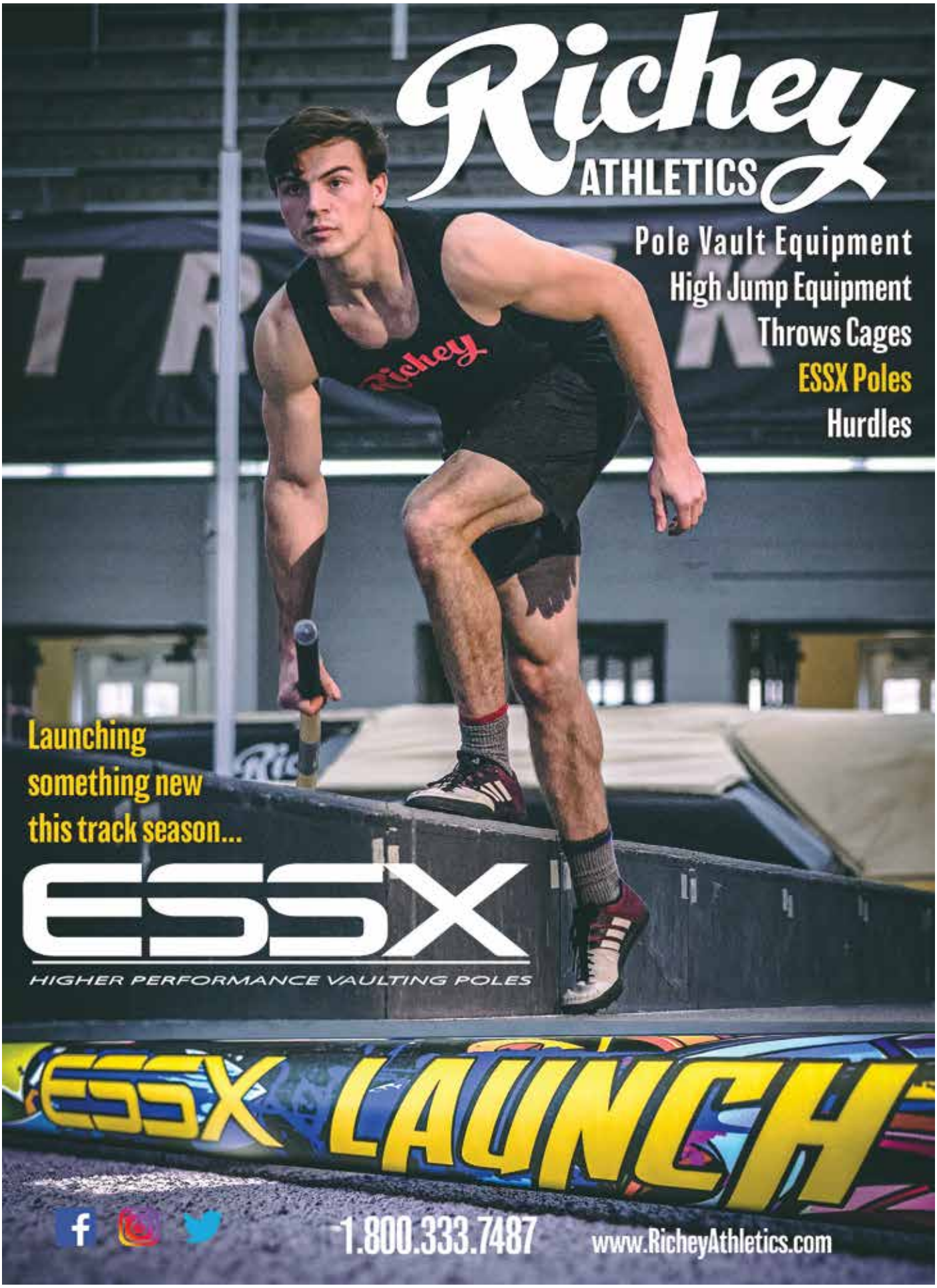
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High Jump Microcycles

Training Elite Female Jumpers

STEVE THOMAS

KIRBY LEE IMAGE OF SPORT

To construct a microcycle for elite female high jumpers, we must first take a snapshot of what comprises an elite female high jumper. Listed below are the top ten performances among female high jumpers. All these athletes have reached the ranking of International Master of Sport.(see chart)

Weight must be related to height because 130lbs with a height of 5'4" (2.03lbs/1" of height) is totally different from 130lbs with a height of 5'11" (1.83lbs/1" of height). The amount of speed and impulse needed to jump the same height is greatly increased for the shorter jumper with the same weight. The other parameter that stands out is that if you are going to have more than 2lbs per 1" of height (Vlasic and Cloete), you must possess another attribute to compensate for access height/weight. Both Vlasic and Cloete are over 6' tall and are therefore able to jump at less height over the top of their head (least amount the top ten-Vlasic 6¼" and Cloete 8").

If we remove the two height/weight ratio anomalies (Vlasic and Cloete), it completely changes the elite female high jump profile. The average height changes from 5'11¼" to 5'10½". The average weight goes from 132.2lbs to 127.25lbs, and the height jumped over height goes from 10" to 10¾". The height to weight ratio changes from 1.84lbs per inch of height to 1.80. The height/weight ratio will be a determining factor in achieving elite status in the women's high jump.

From this snapshot, we are able to see that the elite female high jumper is tall (average height is 5'11¼") and very lean (average weight 133.1lbs and 1.86lbs per 1" of height). Takeoff height is not dependent on the approach. Therefore, taller jumpers have an advantage. They must possess the physical traits (speed, impulse and technique) that allow them to jump 10" over the top of their head. The microcycle composition for the female high jumper will be very different from their male counterpart in that the female will rely more on speed strength in training and the male will focus more on maximum strength.

ATHLETE	PB	HGT.	WGT.	LBS/1" HGT.	HGT. JUMPED OVERHEAD
Stef Kostadinova	2.09(6'10 ¼")	5'11"	132lbs	1.85	11 ¼"
Kajsa Bergqvist	2.08(6'9 ¼")	5'9"	130lbs	1.88	12 ¾"
Blanka Vlasic	2.08(6'9 ¼")	6'4"	154lbs	2.02	6 ¼"
Lyudmila Andonova	2.07(6'9 ¼")	5'9½"	132lbs	1.89	11 ¾"
Heike Henkel	2.07(6'9 ¼")	6'0"	130lbs	1.80	9 ¼"
Anna Chicherova	2.06(6'9")	5'11"	123lbs	1.73	10"
Hestrie Cloete	2.06(6'9")	6'1"	150lbs	2.05	8"
Yelena Slesarenko	2.06(6'9")	5'10½"	119lbs	1.68	10 ½"
Ariane Friedrich	2.06(6'9")	5'10"	126lbs	1.80	11"
Mariya Lasitskene	2.06(6'9")	5'11"	126lbs	1.77	10"
AVERAGE		5'11¼"	132.2lbs	1.84	10"

There is little to no research on how weight affects human performance. We have to turn to thoroughbred horse racing to find the effects of weight on performance. How much weight do you have to add to a 1200 pound thoroughbred horse in a race to affect performance? 20 pounds? 40 pounds? 60 pounds? The answer is two pounds. Adding two pounds to a 1200 pound thoroughbred racehorse accounts for an eight foot difference at the end of the race.

If two pounds affect a 1200 pound thoroughbred horse, how many ounces affect performance in an elite female high jumper? Weight must be monitored by the athlete and coach because it has an effect on performance. What the athlete must know is what they put into their body will have an effect on performance. Nutrition is very important in the athlete's performance and career.

The one variable not displayed in the above chart is leg length in relationship to overall height. Elite female high jumpers are going to be "all legs." They will have a short torso and must have an inseam that makes up a minimum of 49% of their total height. While the better jumpers will be somewhere between 50-51% of their total height. The elite female high jumper will not possess a swimmer's body (all torso and no legs).

When planning the training program, the composition of the microcycle is very important and can be difficult. The correct design of the microcycle is a determining factor in planning a successful training program. One of the main objectives in planning is to create a great training effect for the work accomplished and closely monitor the athlete's rehabilitation processes.

The preparatory period is divided into three mesocycles:

• **General-Basic Mesocycle:** This is at the beginning of the preparatory period and last 4-6 weeks. The objective is to establish the basis for the physical and technical preparation. The microcycle will consist of 10-12 training sessions.

• **Special-Basic Mesocycle:** This cycle will last 12-13 weeks with the objective to develop the technique and special physical qualities of speed, strength and reactive strength. Each microcycle will have 8-10 training session during the mesocycle.

• **Preparatory Mesocycle:** This mesocycle is the link between the preparatory period and the competition period. It is about 2-4 weeks. Training is directed at preparing for the upcoming competition period. In the preparatory mesocycle, each microcycle will have 7-8 training sessions.

It is impossible to complete several training activities in one session, so activities that differ in direction are combined daily. This means that there are different training sessions on a given day, usually including one training session in the morning and one in the afternoon. Rarely are there three sessions in one day (2 in the morning, one in the afternoon or 1 in the morning and 2 in the afternoon).

During the General and Special-Basic mesocycles, the structure and planning of the training week are the same. They differ in the type of training, the number of training means used, and the volume and intensity. When planning, this must be kept in mind. (see chart)

During the General-Basic mesocycle, technical training is done two times a week (Monday and Friday). On Monday, the technical elements are basic in nature (circle runs, technical running, transition technique from a walk or very slowly, etc.). Transition is the last three steps of the jump. On Friday, three step jumps over a bar are performed. This can also be done off an incline board. These sessions are after recovery days on Sunday and Thursday.

The training sessions for strength are also done two times weekly on Tuesday and Saturday. On Tuesday, the strength training is designed for Explosive Strength. Saturday, the session is geared to Maximum Strength. These sessions precede the technical sessions to invigorate the neuromuscular system for the technical session. These force development sessions are intentionally placed in the microcycle on Tuesday for the Friday technical session and on Saturday for the Monday technical session.

Three days a week are dedicated to the development of reactive strength or the Stretch-Shortening Cycle (SSC) mechanism of the muscle. On Monday and Friday, horizontal multi jump exercises are performed. Wednesday is devoted to vertical jumping using drop jumps.

A note must be inserted here. The Drop Jump and the Depth Jump have become synonymous. Although they seem similar, they have two different objectives. The Drop Jump is from a height of 20-60cm; hands are placed on the hips and not used on the rebound; the athlete is attempting to get off the ground as quick as possible with as little amortization as possible; the objective is to rebound as high as possible onto a box with the legs straight on landing. The Depth Jump or Shock Method develops Explosive Strength, Reactive Ability and Maximum Strength. It has a tremendous training effect on the neuromuscular system. It increases the intensity of the motor neuron stimulation, creates the elastic potential of muscle tension and increases the speed of the stretch-shortening cycle (SSC). The Depth Jump heights for males is .75-1.10m depending on the training objective. With .75m being the optimal height for Explosive Strength and Reactivity Ability, and 1.10m ideal for Maximum Strength development. For female athletes, the height is .63-.98m. The exercise regime should begin with two sets of eight repetitions and should not exceed four sets of ten repetitions. The recovery between sets is 4-6 minutes of easy running/skipping. A minimum of 48 hours between Depth Jumps is required; 72 hours is

General-Basic Mesocycle (4-6 Weeks):

Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Technique	Strength	Hurdles	Games	Technique	Strength	Walk
Jump	Circuit	Drop Jumps	Rehab	Jump	Circuit	Rehab
Exercise				Exercise	Running	
Sprints				Sprints		

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Running is done three days a week (Monday, Wednesday, Friday). On Mondays, the running session is longer in nature (repetition 60-100m). Wednesday sessions consist of hurdle running with a rhythm of 3-5-7 steps between hurdles. Friday is for short sprints (20-60m). Two days a week are dedicated to general physical preparation (GPP). Tuesday and Saturday are dedicated to circuit training and cross country running. Active rest and rehabilitation are planned two days a week (Thursday and Sunday). Games like volleyball and basketball are advised.

The Monday and Friday sessions are broken into two sessions a day, with the technical session in the morning and remainder of the session in the afternoon. The microcycle is designed for maximum production in training effect for each exercise and should be followed in the order given. The General Basic Microcycle could be similar to this:

Monday: (AM) Technique-3 Step Transition Walk Throughs focus on Catching the Arms and Drive Leg X 25-30 Repetitions

(PM) Jump Exercises-5 Double Leg Hops for Distance X 4-6

10 Bounds for Distance X 4-6

Sprints-2 X 80m with a Standing Start

2 X 100m with a Standing Start

Tuesday: Strength Training (Explosive Strength)

Circuit Training

Wednesday: Hurdles-6 to 8 Hurdles X 6-8 Repetitions 3-5-7 Steps between Hurdles

Drop Jumps-2 to 4 X 8-10 Repetitions off 30cm (12") Box onto 30cm (12") Box

Thursday: Games-Basketball 2 X 8 minutes or Volleyball

Rehabilitation-Massage

Friday: (AM) Technique-3 Step Jumps X 25-30 focus on Arms and Drive Leg

(PM) Jump Exercises-4 to 6 X 50m Alternate Leg Bounds for Contacts and Time

Sprints-4 X 30m with Flying Start

2 X 60m with Flying Start

Saturday: Strength Training (Maximum Strength)

Circuit Training

Running-4000 to 5000m Aerobic Run

Sunday: Walk 2000-3000m

Rehabilitation-Massage or Contrast Bath or Water Massage

(see chart)

The Special Basic Mesocycle is similar to the General Basic Mesocycle, but there is some substantial re-grouping of the training. The technical preparation is carried out three times a week.

- Monday, 5-6 step jump with or without incline board
- Wednesday, approach improvement working on accuracy and rhythm
- Friday is full approach jumps

Because vertical jumping is vital to high jump success, they are a priority and added twice a week (Monday and Friday) after jumping. Wednesday is devoted to horizontal jumping (bounding, hopping, etc.). The running on Wednesday remains the same to and the focus is on rhythm. Saturday is changed to Fartlek running.

Monday, Wednesday and Friday has two training sessions with the technical sessions being performed in the morning. During this mesocycle, rehabilitation is mandatory. Massage, water therapy, sauna and contrast bathes must be used. The microcycle during the mesocycle can be as follows:

Monday: (AM) 5-6 step jumps 20-30 times (with and/or without incline board)

(PM) Depth Jumps 2 X 8 (gradually increasing to 4 X 10) off .63-.98m (25-38") Box

With 4-6 minute active recovery

Running-2 X 80m from standing star

2 X 100m from standing start

Tuesday: Strength Training-Explosiveness and Speed

Jump Exercise-Ankle Hops 4 X 20 Hops; 5-6 X 10 Alternate Leg Bounds for Distance

Flexibility-Hurdle Mobility Exercises for Hips; Abdominal and Postural Exercises

Wednesday: (AM) Technique-12 X Full Approach Runs focus on Rhythm/Accuracy

12-15 X Transition focusing on Arms and Drive Leg in Takeoff

15-20 X Box Flops over the Bar

(PM)Hurdles-6 to 8 repetitions of 5-6 Hurdles

2-3 repetitions of 8-10 hurdles

Jump Exercise-2 X 10 Alternate Leg Bounds; 4 X 10 Left Leg Hops onto 15cm (6") Box Continuous

4 X 10 Right Leg Hops onto 15cm (6") Box Continuous

Thursday: Game: Basketball 2 X 5 Minutes Sauna and Massage

Friday: (AM) Technique-8 to 10 Full Approach Jumps 20cm (8") below PB

8-10 Full Approach Jumps 15cm (6") below PB

6-8 Full Approach Jumps 10cm (4") below PB

4-6 Full Approach Jumps 5cm (2") below PB

(PM) Depth Jump-3 X 8 (gradually increasing to 4 X 10) of .63-.98m (25-38") Box

Sprints-3 X 30m with a Fly Start

3 X 40m with a Fly Start

Saturday: Strength Training-Rate of Force Development (RFD)

Jump Exercise-10 X 5 Double Leg Jumps for Distance

Special Basic Mesocycle (12-13 Weeks)

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
Technique	Strength	Hurdles	Games	Technique	Strength	Rehab.
Jumps	Jump	Jumps	Rehabilitation	Full Jumps	Jumps	
Depth	Exercises	Horizontal		Depth	Double Leg	
Jumps	Flexibility	Technique		Jumps	Fartlek	
Running		Approach		Sprints		

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Fartlek-2 X 6-8 minutes

Sunday: Massage
Water Therapy

(See chart below)

The Preparatory Mesocycle and Microcycle is to prepare the athlete for the upcoming Competition Period. The intensity is increased and the volume is reduced. Training sessions are shorter in duration and more focused on the competitive readiness. Monday, Wednesday and Sunday have two training sessions with each session lasting 60-90 minutes.

The microcycle can be similar to this:

Monday: (AM) Technique-Full Approach Jumps
4-6 Jumps 15cm (6") below PB
2-4 Jumps 5cm (2") below PB
4-6 Jumps 3cm (1") below PB
(PM) 4-5 X 6 Hurdles 3 Step Rhythm
Depth Jumps-2 X 10 @ .63m (25")
2 X 10 @.98m (38")

Tuesday: Strength Training (RFD)
Drop Jumps-3 X 8 off 45cm(15") Box onto 45cm(15") Box

Wednesday: (AM) Technique-Full Approach Runs X 10-12 Focus on Rhythm
(PM) 2 X 10 Continuous Jump Left Leg onto 15cm (6") Box
2X 10 Continuous Jump Right Leg onto 15cm (6") Box

Thursday: Recovery

Friday: Technique-Full Approach Runs X 10-12 Focus on Accuracy
Sprints-2 X 30m Flying Start
2 X 60m Flying Start
Saturday: Jump Exercises-2 X 5 Double Leg Hops for Distance
2 X 10 Alternate Leg Bounds for Distance

Sunday: (AM) Technique-Full Approach Jumps
4-6 Jumps 10cm (4") Below PB

Preparatory Mesocycle (2-3 Weeks)

Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.
Technique Hurdle Runs Depth Jumps	Strength Training Drop Jumps	Technique Jump Exercises	Recovery	Technique Sprints	Jump Exercises	Technique STJ Test Speed Test

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2-4 Jumps 5cm (2") Below PB
4-6 Jumps at PB and 3cm (1") Above PB
(PM) Testing-Standing Triple Jump (STJ) Test
Speed Test-Fly 20m Test

As in the majority of track and field events, performance in the high jump can be improved by developing speed strength and exploiting it through enhanced technique. These two tasks are inseparable, but it should not be forgotten that the improvement of speed strength determines the improvement of technique and must come first. Improvement in technique depends largely on the jumper's physical state.

The strength training sessions are designed to develop speed strength. The coach and athlete should understand that using weight that is 30-50% of the athlete's maximum will improve the jumper's speed. The long use of weights 70-90% of the athlete's maximum will considerably increase the strength component of power. The use of weights in the range of 90% of the athlete's maximum is recommended for jumpers who have a low level of development in the speed component of power.

The microcycle must have a minimum of two training sessions designed for weight control, and with athletes who struggle with weight, a third session can be added. A great nutrition program is paramount to the athlete's performance and health. Not eating is not an option. Food is the fuel to high caliber performance, so not eating to lose weight is pure foolishness. Making great choices of food intake will prolong an athlete's career and health. Weight reduction must be sensible, and it is advisable to use a nutritionist.

Microcycles must be individualized to the high jumper to maximize performance. These microcycles should be used as examples in designing microcycles for other high jumpers. These microcycles are designed for female high jumpers who have reached a level of at least Master of Sport and higher. That must be understood by the coach, so the volume and intensity is high and must be reduced for lesser athletes.

To become an elite athlete requires talent, but talent alone will not make one an elite athlete. To become an elite athlete requires the athlete to become great at three things. They must become great at giving maximum effort. This means paying attention to the smallest detail. Everything is important and requires constant diligence to perfection. Perfection may be impossible but attempting impossible is always possible. Secondly, the athlete must become great at being uncomfortable. There is no improvement without discomfort. Thirdly, the elite athlete must become great at sleep. Training is useless with rest. Nocturnal athletes will never reach elite status.

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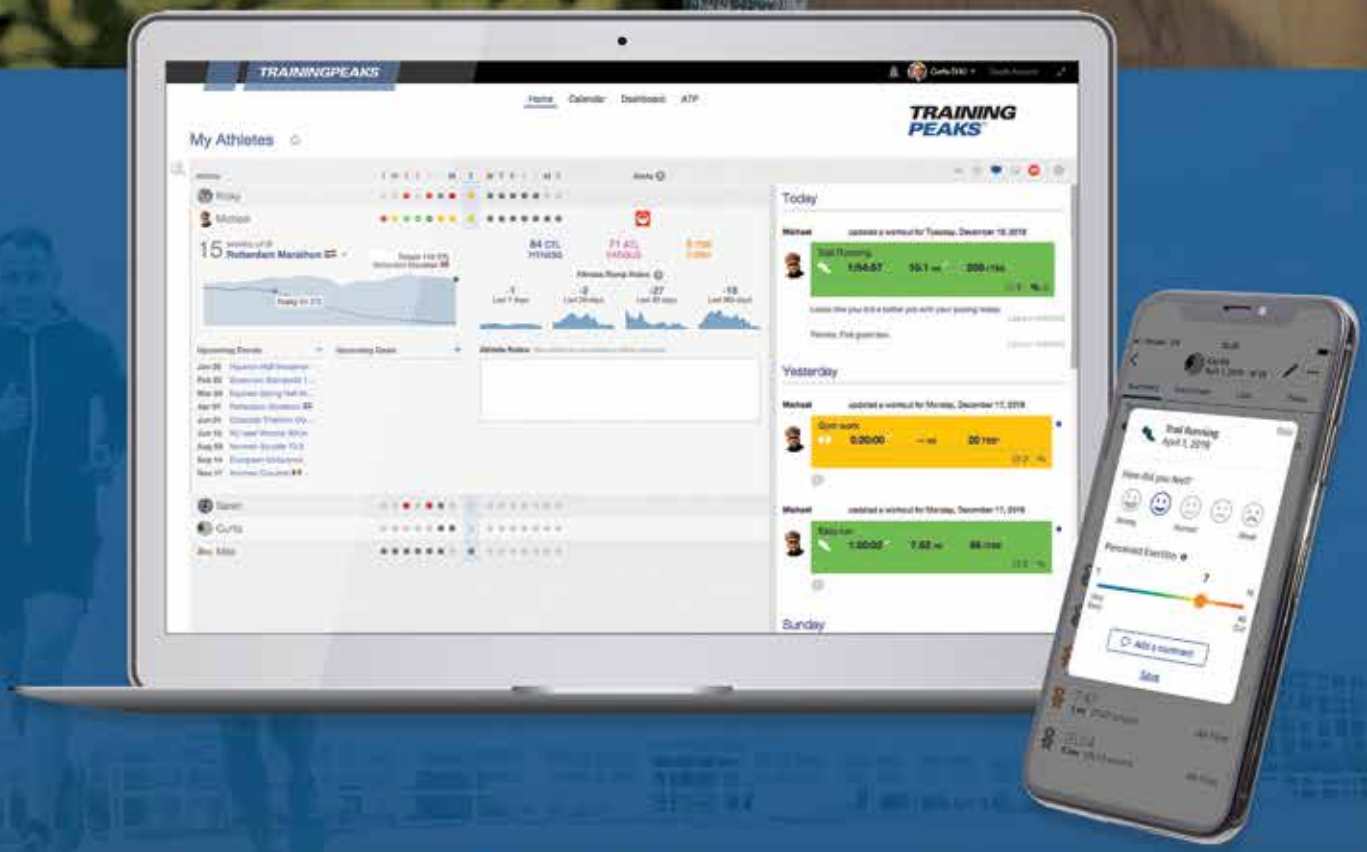

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THE SQUAT EXERCISE

A Must for the Track and Field Athlete

JOHN M. CISSIK

The squat exercise has been a mainstay in athletic strength training programs for decades. This can be a difficult exercise to perform, and athletes can work up to a lot of weight on it. While this exercise has been a foundational exercise for athletes, there is always something new coming up on the internet that is "better" than the squat.

Track and field requires athletes to be able to achieve horizontal velocity (through sprinting), vertical velocity (through jumping), and to be able to exert force against an implement (for example, throwing a shot put). All of these involve exerting force against the ground. The squat (along with its variations) is important because that is exactly what the exercise is training athletes to do.

In each track and field discipline, it is also important to be able to maintain posture. For example, a sprinter must be able to maintain their posture at foot-strike. A jumper must be able to maintain posture during the plant. The thrower must be able to maintain posture while levering off one side of the body. The squat and its variations help to develop the strength to be able to maintain posture during the performance of track and field events.

This article is going to cover several variations of the squat exercise. It will cover why some of the exercises we see on the internet might not be necessary for the track and field athlete. Finally, it will cover how to incorporate the squat into a track and field athlete's training program.

VARIATIONS OF THE SQUAT

BACK SQUATS

Back squats involve squatting with the barbell on the back of the athlete's shoulders. The athlete should have the bar resting where it is comfortable for them. Some athletes like it higher (almost on the neck) and others like it lower (almost on the rear deltoids). For a track and field athlete, the most important thing is to give the athlete the flexibility to be able to put the barbell where it is most comfortable for them.

The athlete's feet should be between hip-width and shoulder-width apart. We want to avoid anything more extreme than that, as it won't be beneficial to being a better track and field athlete.

The entire time the bar is on the back of their shoulders, we want the athlete to be protecting his or her lower back. This is done by sticking the chest out and pulling the shoulders back. If this is done, then the weight will be evenly distributed across the athlete's vertebrae. If the athlete's shoulders are allowed to round forward, then this is the recipe for a lower back injury – so this is an important coaching cue.

It's also important that the athlete begin the squats by pushing the hips back and unlocking the knees. Doing this keeps the feet flat on the floor and keeps the weight on the athlete's hips. On the other hand, if the athlete begins the exercise by pushing the knees forward, then they will be off balance and the weight will be on the knees (which we don't want) instead of the hips.

The back squat is the foundational exercise for lower body training. It strengthens pretty much every muscle from below the diaphragm. It strengthens the athlete's skeleton and joints. It also involves exerting force against the ground, which is what track and field athletes do. Finally, athletes can become really strong on this exercise.

SPLIT SQUATS

Split squats are squats where the bar is on the back of the athlete's shoulders. However, unlike back squats, the athlete will have one foot in front of them and one foot behind them; in other words, they will be in a split position.

The front foot will be flat on the ground. The back foot will be far enough back that the ball of the back foot will be on the ground. From this position, the athlete will flex their front knee and hip lowering themselves until their front thigh is parallel to the ground. From that position, they will reverse directions and repeat. After the desired number of repetitions have been performed, the athlete will switch legs.

Like the back squat, the athlete will want to protect their lower back. An important thing to pay attention to with split squats is that we want to avoid letting the athlete touch their back knee to the ground. This is because as we get tired, we tend to rush, which can result in slamming that back knee against the ground.

The split squat primarily focused on the front leg. The back leg helps some during the exercise, but the focus is on the front leg. This is important because track and field athletes sprint with one leg in contact with the ground at a time, and they lever off one side of the body. I start athletes out on this exercise with 30-50% of their back squats, but they can eventually work up to 70-85% of that!

One thing we want to avoid with this exercise is putting the back foot on any raised surfaces (like a box, bench or stability ball). I understand that everyone has seen the webpages and videos with people doing just this, but the problem is that it creates an unstable situation. An unstable situation is a problem for two reasons. First, it doesn't happen in track and field. Second, it invites injuries.

PAUSE SQUATS

Pause squats can be done as either back squats or split squats. In a pause squat the exercise is performed exactly like the regular variation with one important exception: the athlete will pause for a full count in the bottom position. For example, the athlete will squat down into the bottom position and then pause before standing up. Good form needs to be emphasized while the athlete is paused — this is not a time for the athlete to relax!

TABLE ONE: SAMPLE TOTAL BODY TRAINING SESSIONS.

	Day One	Day Two	Day Three
Exercises:	Power clean Back squats Romanian deadlifts Bench press Bent over rows	Power snatch Split squats Good mornings Incline press Pull-ups	Push jerk Deadlifts Glute ham raises Military press Dumbbell rows

TABLE TWO: SAMPLE LOWER BODY/UPPER BODY TRAINING SESSIONS.

	Day One	Day Two	Day Three	Day Four
Exercises:	Power clean Back squats Lunges Romanian deadlifts	Push jerk Bench press Dips Bent-over rows Shoulders	Power snatch Split squats Good mornings Hyperextensions	Split jerk Incline press Pull-ups Military press

TABLE THREE: SAMPLE TRAINING SESSIONS BY QUALITY.

	Day One	Day Two	Day Three
Exercises:	Back squats Romanian deadlifts Bench press Bent-over rows Military press	Power clean Snatch pulls Push jerk	Superset: Split squats and push-ups Superset: Lunges and pull-ups Superset: Good mornings and dumbbell military press Superset: Inchworms and bear crawls

This is an important exercise for a track and field athlete. Not only does it work on strength, but it also works on posture and eccentric strength. In other words, this is an exercise with a direct impact on the performance of the athlete's event.

Normally, I start athletes out with 70% of what they would have done in the back squat or split squat. They can eventually work up. This is also a low volume exercise, usually in sets of three to four repetitions.

ECCENTRIC SQUATS

Like pause squats, these can be done with back squats or split squats. They are performed exactly like the back squat or split squat with one important difference: the descent is exaggerated. Normally an athlete will take ten slow seconds to lower themselves to the bottom position and then reverse directions. Like with pause squats, technique needs to be emphasized while performing this exercise (it is very tiring).

Like pause squats, athletes will begin with around 70% of what they would have done on the back squats or split squats. This is also another low volume exercise. There is no need to do more than three to four repetitions per set.

WHAT ABOUT...?

There are exercises missing from above. There are no front squats, box squats, overhead squats, goblet squats, bands or chains mentioned. There are several reasons for this.

First, some exercises require an enormous investment in learning to be able to perform them with proficiency. This includes front squats and overhead

squats. We have to keep in perspective that the goal behind an athlete's strength and conditioning program is to physically prepare the athlete to be better at his or her event. A coach has to carefully consider whether the time spent learning the exercise will have a return at improving the performance of the athlete's event.

Second, some exercises are designed for specific situations that come up in strength training sports. For example, the front squat strengthens the athlete for the clean in Olympic lifting. The overhead squat strengthens the athlete for the snatch in Olympic lifting. Box squats train a specific range of motion during the powerlifting squat; in other words, they focus on where a powerlifter is weak in the squat. Bands and chains are also strengthening parts of the range of motion in a powerlifter's squat. None of this may be needed for a track and field athlete!

Third, some exercises are useless for a track and field athlete. By this, it should be understood that some exercises look great on social media but just don't provide the stimulus that a track and field athlete needs to get better.

Finally, some exercises are dangerous. For example, if an athlete is even a little off during the overhead squat, there is a shoulder or elbow injury waiting to happen.

HOW TO PROGRAM

The squat (and its variations) is a primary exercise in a strength and conditioning program. This means it should be done towards the beginning of a training session, shortly after the warm up. There are many ways to organize a track and field athlete's training. The athlete may perform total body training sessions, they may do lower body/upper body training sessions, or they may organize the sessions by physical quality.

TOTAL BODY TRAINING SESSIONS

With this type of organization, the athlete typically trains two to three times a week with strength training. Total body training sessions normally consist of a power exercise, 1-2 lower body strength exercises, and 1-2 upper body strength exercises. A sample of this is in table one. See Table One

Notice that the squats (or deadlifts) are the second exercise in the training session, immediately after the total body power exercise. This is because the squats (and deadlifts) are more strenuous and more important than the rest of the exercises. The power exercise is performed first because we want the athlete to be relatively non-fatigued when performing this exercise.

LOWER BODY/UPPER BODY TRAINING SESSIONS

These training sessions tend to be longer, focusing on more exercises in each session. There also tends to be four training sessions per week (two lower body, two upper body). Table two shows a sample of this type of workout. (See Table two)

There don't need to be a lot of exercises to get a benefit from the training, but it does require more days of training each week. The back squats and split squats are still performed second in the workout, immediately after the power exercise.

PHYSICAL QUALITY

Strength training, like track and field training, can be organized around physical qualities. This helps the coach to align the training with what is being done in the event so that strength training complements and supports rather than competes with the event training. Frequently, this means a strength session, a power session, then a hypertrophy session. Depending upon the time of year, there may be a great emphasis on one quality. For example, with collegiate athletes, there may be more strength sessions from October through December as the athlete prepares for the indoor season. Table three provides an example of this type of training organization.(See Table Three)

In table three, day one is a maximal strength session. The intent would be 80-90% of maximum and a low volume (6 repetitions per set or fewer). Day two is a power session, this would be 60-80% of maximum, with around three repetitions per set. Day three is a hypertrophy day, 70-80% of maximum, 8-12 repetitions per set. Notice that the squats are done first on the respective training sessions because in those workouts, those exercises are the most important in the session.

This approach to training helps to align strength training to event training. For example, day one aligns well with acceleration training, day two with maximum velocity training, day three with speed endurance.

The squat is a key exercise for the track and field athlete. Besides being important, there are variations that can be important once the basic exercise is mastered. Having said that, there are also a great many exercises that may not provide a great return on the time invested.

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Learning from the Experts

Mechanisms of Tactical Development for Distance Coaches

MATTHEW BUNS, PH.D. AND TYLER ANDERSON

KIRBY LEE IMAGE OF SPORT

The idea of expertise is an appealing topic in numerous domains, including track and cross country. Defining "expert" traits in certain conditions has been the first step in expertise research and is often relative.

A high level of performance in competition is only one way to define expertise. Other definitions can range from describing the best long jumper on a junior high track and field team to an Olympic champion in the decathlon. Regardless of how "expertise" is defined, the path leading to expertise in track and cross country derives from specific components of skill, coordination and the human body's physiological response to training, stress and progress. Extensive research provides evidence that levels of sport performance are influenced by knowledge (Buns and Thomas, 20011). In the domain of sport, the phrase "knowing what to do" has been used to describe declarative knowledge, and the phrase "doing it" has been used to describe procedural knowledge. Knowing precedes doing; thus, knowledge is critical to the development of expertise in track and cross country. The purpose of this article is twofold: 1) describe how expertise is influenced by knowledge, and 2) share the mechanisms of tactical development utilized by outstanding distance coaches to improve athlete's speed and accuracy of decision making during competition.

THE RELATION OF KNOWLEDGE AND PERFORMANCE

The majority of research literature illustrates differences between experts and novices when it comes to knowledge (Thomas and Thomas, 1994; French et al., 1996). In track and cross country, skill and knowledge limit performance during competition. In the event of achieving expertise, a continuum of stages must be fulfilled. Attaining declarative and procedural knowledge ranks among the primary of these stages, with skill and performance during competition to follow. Knowing what to do (declarative knowledge) has been shown to precede the ability to perform motor or sport skill (procedural knowledge). This idea was first demonstrated in a classic study of performance in relation to knowledge, whereby the development of sport knowledge played a significant role in skilled sport performance levels (French and Thomas, 1987). Decision-making ability was the major determining factor in this study, showing that the change in performance over the course of a season was due to an increase in the athlete's ability to make appropriate decisions during competition, rather than an increase in motor skills. These findings suggest that a) cognitive skills in sport progress at a faster rate than

motor skills, and b) the development of the sport knowledge base can influence actual performance during competition without attainment of high levels of skill – an important finding! Without the presence of this knowledge, expert levels of performance are not achieved.

SPEED AND ACCURACY OF DECISION MAKING

Speed and accuracy in decision making has been identified as a critical feature in success in sport. The ability to make rapid, accurate decisions in sport is a characteristic that sets experts apart from novices. In track and cross country, decisions must be accurately and rapidly, and this influences expertise. Although long-distance racing is not widely considered to be a high-strategy or fast-paced sport, it is often essential for athletes to make very quick decisions about the nature of the action to be performed. Sanger, Buns, and Thomas (2019) used scenario coaching with athletes to significantly improve the speed and accuracy of decisions. The largest improvements in decision accuracy took place at the lowest experience level, suggesting that athletes with the lowest amount of experience may benefit the most from tactical, "if-then-do" training. These findings support the idea that knowledge improves both speed and accuracy of decisions, but these improvements may be expressed differently at various knowledge levels. The speed at which these decisions are made is directly related to the knowledge base.

ACCESS TO A KNOWLEDGEABLE COACH

Access to a knowledgeable coach during the learning process is essential to skill and tactical development. Research has shown that time spent with a coach is critical to an athlete's overall development (Horton, Baker, and Deakin, 2005). Given that a coach is normally responsible for a high percentage of an athlete's practice time, the coach's ability to devise an optimal learning environment becomes significant to an athlete's development (Buns and Thomas, 2011). Unfortunately, the ability for coaches to convey expertise to athletes during competition is often limited, with few opportunities for interaction between coach and athlete. Thus, athletes must rely on their own base of knowledge and decision-making capabilities during competition. The accuracy and speed of decisions made in these situations have been directly correlated to the availability of a sufficient networking system of nodes and links developed through tactical training and experience. In order to be fast and accurate in the decision-making process, the appropriate knowledge must be available. There are many paths to knowledge: instruction, reading, study and coaching. A challenge is finding engaging and accurate sources of knowledge.

So, what do effective track and cross country coaches do to teach distance-running tactics for understanding? Are they concerned about the role of procedural knowledge? Do these coaches have unique problem-solving scenarios for distance runners? Do they employ superior strategies in the pursuit of improving the speed and accuracy of decisions? The purpose

TABLE 1. PRIMARY RACING PROBLEMS AND STRATEGIES COACHES USE TO HELP ATHLETES UNDERSTAND AND OVERCOME THE CHALLENGES.

Tactical Problem	Strategy for Teaching Tactical Understanding
Adjusting to Course Differences	Learn the course early in the week (study the map) so you attend to other aspects of performance before the race. Make it a point as part of the pre-race warm-up to identify important landmarks on each course (Mile 1, hills, tangents, last 800 meters, etc.).
Dealing with Pain	The middle stages of a workout are where athletes develop the skill of running through pain. On any type of workout, train with the goal of staying strong in the middle efforts. For example, running 8 miles with a focus on beating the pain on miles 4-6. Or doing 8 x 1,000's with a focus on running repeats 4 to 6 particularly fast.
Finishing Races	Help athletes get a sense of their finishing speed in practice and plan a finishing tactic. One strategy is to finish a moderately intense workout with surprise bursts at the end (e.g., 2 x 600's).
Hill Running	Maintain only a moderate effort at the start of the hill – what matters most is a vigorous intensity once nearing the top of the hill and everything thereafter. Practice running the start (bottom) of a large hill around race pace and accelerating only the last 50 meters of the hill on the way up and the next 200 meters after reaching the top.

Tactical Problem	Strategy for Teaching Tactical Understanding (Cont)
Maintaining Focus	Mental toughness, by definition, refers to an athlete's ability to focus on what matters. This requires a focus on the process, not the outcome. In practice, find creative ways to distract athletes during the warm-up and the running training (similar to stress inoculation training). Encourage athletes to listen to what their body is telling them (and report back afterwards). Athletes who ignore this inner voice might struggle to maintain focus during training.
Overcoming a Fast Start	Some races result in a team starting at a pace much faster than desired race pace. Practice overcoming this fatigue with training consisting of several 800 meter repeats. Require a very fast first 200 meters (at all-out 800 meter race pace) but then settle in so that the total 800 meter time for each repetition matches desired race pace.
Pack Running	A cross country teams' ability to run as a pack is partially reflected by the "spread" time noted at the end of the race. Practice pack running on a tempo run or repetition workout. The practice goal is to run as fast as possible with two rules: 1) lead runners cannot break away from slower runners of their pack, and 2) slower runners cannot lose "touch contact" with their pack.
Patience	An even-paced race (with a fast finish) is generally considered the most efficient way to run a long distance race (5K or longer). Use "negative-split" workouts to ensure athletes are not inducing insurmountable fatigue early in the effort. Practice early control through the first half of the workout to practice maintaining control through the first half of the race.
Race Modeling	Design workouts that induce specific race responses reflective of the race strategy. Use intervals or repeats at race pace that require the following approach: running controlled early, tough in the middle, and closing out strong when fatigued. As the season progresses or athletes improve, the length or number of intervals can also increase.
Running the Turns	Athletes that only run in straight lines during practice are not prepared for a cross country course with tight turns. Design grass/trail training with a significant number of left and right turns at race pace or faster (use cones if necessary). It can be more advantageous to run turns wide at full stride than to run tight with a disrupted gait. On the other hand, athletes are often surprised with how much distance can be saved by running the tangents to shorten the total distance run (measure it for them as an object lesson).

Tactical Problem	Strategy for Teaching Tactical Understanding (Cont)
Segmentation	Similar to race modeling, some coaches communicate the idea of breaking the race into manageable segments or "chunks." This can be practiced by breaking the distance of the race into smaller segments, such as repeat miles or 1ks that equate to the total length of the race. On your home course, athletes can practice each segment with a small amount of rest between each. This strategy is thought to improve athlete confidence in their ability to race.
Starting Races	The importance of a strong start increases with the size of the race. Develop a starting plan for the entire team and assign a specific task to each runner for the start of the race (and practice this regularly before race day). Locate a practice area that resembles the first 400 meters of a particular course you will be running. In practice, arrange runners on the line in the configuration they will use in a race. Assign one runner to lead the group out and give each runner another person to follow. Run 5-10 practice starts with runners focusing on this task, staying within touching distance of their teammate. It has been said that for every second you go out too hard during the first 400 meters, you lose three later in the race.
Surging	There is an art and science to the surge. The surge should be utilized selectively and typically only on the back half of a race. Physiologically, a gradual surge is more economical and less taxing to the system. Strategically, a quick surge does force opponents into a quick decision about whether to keep pace or not. To practice surging, find a loop that can be run three times for each repetition (or use a 400 meter track). Run the first and third loop of each repetition at race pace, and the second loop at a significantly increased pace.

of this investigation was to examine the teaching approaches cross country coaches use to help runners make sound tactical and strategic decisions during competition. The intention was to determine whether these coaches used unique or innovative techniques or strategies that contributed to tactical success during competition.

LEARNING FROM THE EXPERTS (METHODOLOGY)

For the purposes of this article, an Internet search was conducted to identify head cross country coaches with publicly available contact information from NCAA Division I, NCAA Division II, and NCAA Division III programs. Coaches were asked to complete an online survey that included demographic questions related to level of competition, coaching experience and accomplishments, as well as open-ended questions concerning coaching pedagogy. The following open-ended questions were designed to help identify common tactical problems runners face (according to coaches) and how coaches design practice situations to overcome these challenges.

List the primary racing problems or tactics you teach cross country runners to overcome (e.g., pacing, hill running, pack running, etc.).

What strategies do you use to help athletes understand and overcome the challenges you listed above? Consider specific activities you implement in practice to help athletes make sound decisions on their own during competition.

What questions do you ask to develop "thinking" athletes?

Sixty-seven (67) coaches were identified and contacted by the described process. Twenty coaches (30%) completed surveys satisfactorily. Of these 20 coaches, 16 (80%) coached NCAA Division I, and 4 (10%) each coached NCAA Division II or NCAA Division III. These individuals had coached cross country for an average of 18 years and reported being a head coach for an average of 11 years. Collectively, these coaches won a total of 40 conference championships, 18 regional championships and 4 national championships.

STRATEGIES FOR DEVELOPING TACTICAL

Understanding in Cross Country (Results)

Although there is no substitute for peak physical conditioning and strong effort, coaches offered practical considerations for increasing declarative and procedural knowledge by teaching critical thinking skills and scenario-based training during practice. Here is a synthesis of the primary racing problems and strategies respondents use to help athletes compete with intelligence and overcome the challenges (See Table 1)

Isolated practice of physical training might work well in practice, but because of the lack of variety or contextual interfer-

TABLE 2. SELF-REFLECTION QUESTIONS FOR ATHLETES DESIGNED TO DEVELOP CRITICAL THINKING.

Questions to Promote Critical Thinking	
Practice	What is your goal?
	What does success in this workout look like to you?
	What do you anticipate being the toughest part of the workout, and how are you going to plan to work through those challenges?
	What is your body telling you right now? Do you feel under control?
	What happened with your worst race? What moment was it?
Pre-Race	What are you scared about? What holds you back?
	Who are you trying to impress? Who is the most important person to you?
	What is your "Plan B" if the race plays out differently than you expect?
	How did you feel?
Post-Race	What did you do well?
	What could have been better?
	Did you race up to your fitness level?
	How do you think this race will breakdown? What can you control?

ence (i.e. lack of variety in the way the skill is applied or is able to be adapted to different situations), the learning may not transfer to competition. Therefore, skill training should be coupled with knowledge training in order to maximize effectiveness. One of the major limitations to performance improvement is the ability of athletes to make sound and appropriate decisions. Even the most physically fit athletes may not have all the information about a situation, so it can be difficult for them to evaluate the feedback and make the appropriate decisions. The coach can assist this process by asking questions that encourage self-awareness of the required performance at a level that the athlete can understand. Table 2 displays a list of questions respondents in this investigation have used to promote critical thinking skills in athletes. By giving athletes opportunities to decide for themselves how or what to do to fix their own errors, or identify a correct performance, the coach enables the athletes to practice and improve their decision-making processes.

CONCLUSIONS

Expecting distance runners to demonstrate effective tactics and other strategies in races without practicing them is like waiting for a cruise ship at an airport – it is not going to happen! The mechanisms of tactical development incorporated by coaches vary widely and should be tailored to the goals of your team, athletes and opponents. The decision as to which tactics to practice and how to organize the practice situation is indeed both an art and science. Some coaches implement regular one-on-one meetings so that athletes understand the tactical concepts they should be developing and working to execute. As one coach stated, "Having them [athletes] take chances in practice helps us execute our plans during racing."

In the continuum of expertise, building a sufficient knowledge base occurs much more rapidly than the refinement of motor skills. Acquiring procedural knowledge can increase the correct response during competition and can contribute to a higher level of overall success. Lack of procedural knowledge would lead to inability to make good decisions in competition. The challenge is finding a way that this can be done, especially in view of the fact that novice coaches may possess limited procedural knowledge. Tactical understanding is complex and should be taught in progressive elements related to the development and experience of the athletes (Kirk and MacPhail, 2002). Furthermore, coaches need knowledge and not running skill; so increasing declarative and procedural knowledge has the potential to impact athletes by providing better coaching.

Developing an athlete's self-awareness is important in providing a source of internal

control rather than the athlete depending on external sources (e.g. you the coach) to evaluate the performance and tell them what to do. The expert athlete is one who is independent and has personal responsibility over his/her performance. In selecting which tactics to practice, coaches should consider the following:

What are the stages of learning and growth and development of each athlete?

What concepts are important for athletes to learn to have success and to meet the overall program goals (tactical, physical, mental, decision making)?

Provided there are limited amounts of time to practice, what are the points of diminishing returns for combining physical training with decision making (contextual practice)?

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RED-S

Conceptual overview, breaking myths around weight and performance, and practical implications for coaches

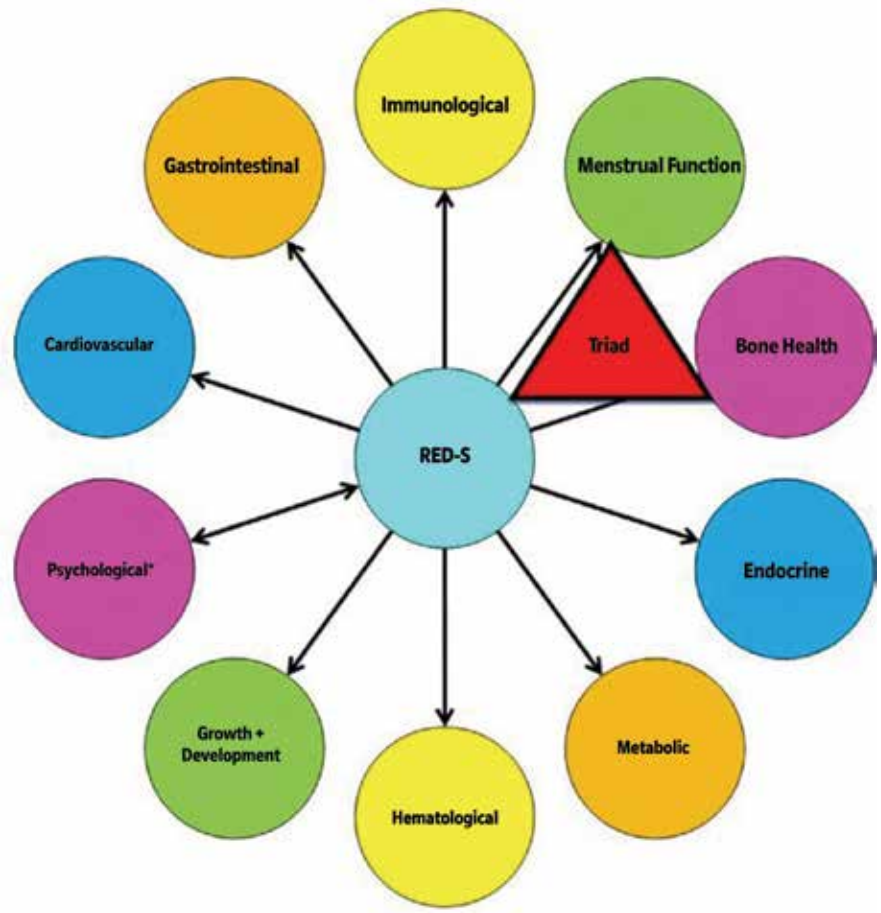
JAMIE NORTON

In 2014, the International Olympic Committee (IOC) convened an expert working group to update their consensus statement on the Female Athlete Triad. That group published a new statement and coined a new term: Relative Energy Deficiency in Sport, or RED-S (Mountjoy et al, 2014). The same group published a follow-up statement in 2018 with expanded and updated research (Mountjoy et al, 2018). Research suggests that inadequate energy availability (EA) leads to detrimental impacts on health and athletic performance that extend beyond bone health and reproductive functions. Additionally, while more prevalent in women, low EA (LEA) also impacts male athletes; thus, RED-S was presented as a broader, more encompassing syndrome to capture these effects (Mountjoy et al, 2014).

"The syndrome of RED-S refers to impaired physiological function including, but not limited to, metabolic rate, menstrual function, bone health, immunity, protein synthesis, cardiovascular health caused by relative energy deficiency" (para. 4) (Mountjoy et al, 2014).

While disordered eating (DE) is often a factor leading to low EA (LEA), athletes may be vulnerable to RED-S without presenting a clinical eating disorder (Mountjoy et al, 2014). RED-S is thought to occur when an athlete has LEA. EA is calculated as energy intake (food calories) minus the amount

FIGURE 1: HEALTH CONSEQUENCES OF RED-S (MOUNTJOY ET AL, 2018)



of energy required to support exercise output, relative to fat free mass (total body mass minus fat mass) (Mountjoy et al, 2014). Put simply, RED-S is indicated when energy provided by food intake is insufficient to support energy expended through exercise and energy required for vital functions. This deficiency does not always have to be large in magnitude to have an impact. Sometimes a sustained deficit of a couple hundred calories a day, or significant within-day energy deficits, can lead to development of RED-S (Mountjoy et al, 2018; Fahrenholtz et al, 2018). In this article, I will discuss what coaches and the HS, College and Elite level can be doing to better understand and address RED-S.

Prevalence of RED-S, and its impact on performance

We need to be aware of the potential for RED-S, through ED/DE or through unintentional under-fueling, in all athlete populations. There is a well-documented history of high rates of DE and eating disorders (ED) in weight-sensitive sports such as track and field. When thinking about DE in track and field, many associate it with female endurance athletes (where RED-S is most prevalent). Researchers have identified RED-S markers in male athletes and in power-speed athletes (Melin et al, 2019). The literature suggests that the prevalence of clinical and subclinical LEA in all track and field athletes is between 18% and 58%, with estimates as high as 60% prevalence in middle distance and distance runners, 22% in vertical jumpers, and 23% in elite female sprinters (Melin et al, 2019).

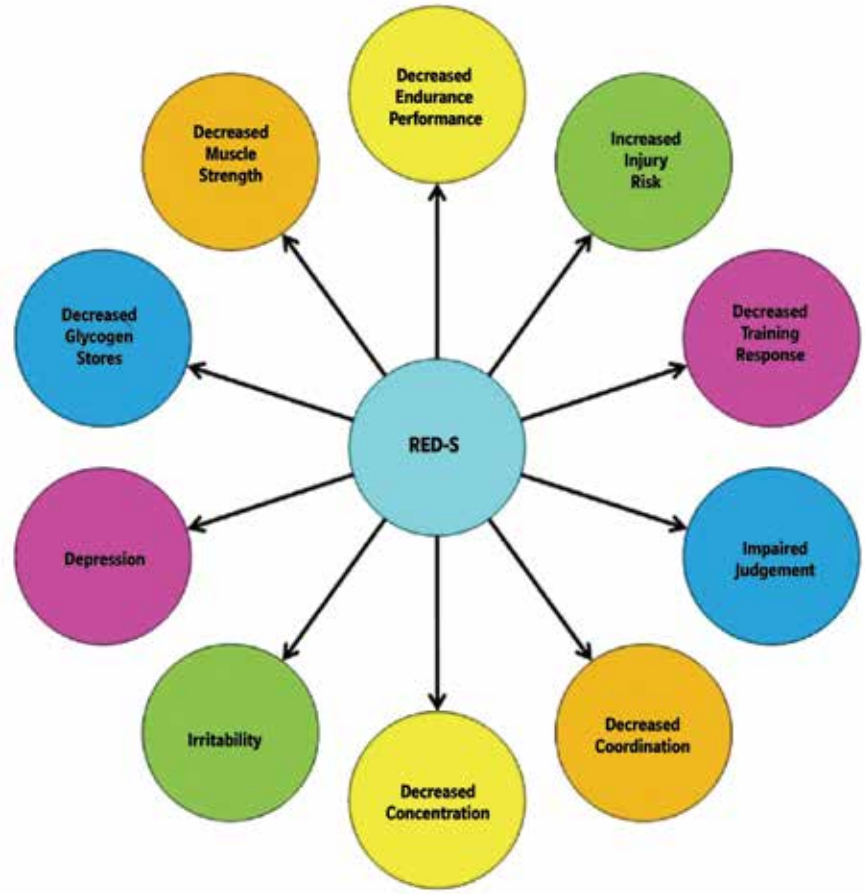
If this is accurate, and we accept the potential for detrimental effects of RED-S, then this should be of critical interest to cross country/track and field (XC/TF) coaches at the High School, Collegiate and Elite levels. Unfortunately, education opportunities for coaches about RED-S remain difficult to come by, and, perhaps as a result, outdated views of nutrition, weight and performance persist. Figure 1 and Figure 2 illustrate the myriad impacts of RED-S.

RED-S remains a conceptual framework and has not been validated through studies that illustrate causality. It involves complex hormonal and metabolic pathways, making it difficult to directly connect LEA to the performance consequences noted in Figure 2. However, a 2014 study tracked 10 junior elite female swimmers and successfully illustrated the correlation between RED-S and negative performance outcomes (VanHeest et al, 2014). Participants were evaluated for menstrual function, hormonal indicators, energy intake, resting energy expenditure, body composition and energy expenditure through training (VanHeest et al, 2014). They followed the same 12-week training program and completed 400m time trials every 3 weeks. Half of the swimmers had normal cyclic menstrual function (CYC), and half showed signs of Ovarian Suppression (OVS) or menstrual dysfunction (VanHeest et al, 2014). The OVS group had significant differences from the CYC group: lower energy intake, lower energy availability, abnormal hormonal cycling, irregular menstruation, higher fat mass (at the end of training) and lower resting energy expenditure (VanHeest et al, 2014). Every swimmer with normal menstrual function improved from their Week 0 to Week 12 time trial, and every ovarian suppressed swimmer got slower (VanHeest et al, 2014). This study illustrates many expected outcomes under the RED-S framework, and it shows a clear decline in performance outcomes associated with lower energy intake and OVS.

WEIGHT AS A KEY PERFORMANCE INDICATOR (KPI)

Many coaches, popular running magazines and sport scientists put forth this notion: if an athlete weighs less, all things being equal, they will be able to cover the same amount of distance faster. A Google search turns up myriad articles about the benefits of weight loss on running performance. They contain caveats that athletes should approach weight loss in a "healthy way," and give passing mention of the dangers of EDs in "obviously misguided" situations. (Johnson, 2012 on Active.com). The

FIGURE 2: POTENTIAL PERFORMANCE CONSEQUENCES OF RED-S (MOUNTJOY ET AL, 2018)



point: athletes and coaches are surrounded with commentary surrounding the benefits of weight loss through sport, particularly distance running. However, when we conflate articles about health-centric weight loss (often targeted at recreational athletes) with the drive to maximize performance in competitive and highly trained populations, we miss essential context.

What these articles ignore is that non-essential weight loss with "all things being equal" (losing excess fat without changes to muscle or energy systems) probably does not exist outside of a laboratory. For decades, people have chased "non-essential weight loss" as a quick-fix for improvement in sport while glazing over the complexities of human performance. That narrative, perpetuated by articles like the one mentioned above, contributes directly to the culture of DE in XC/TF. This excerpt from Dan Bernadot's (2013) research on energy thermodynamics in athletes should be the starting point of any discussion about weight and performance:

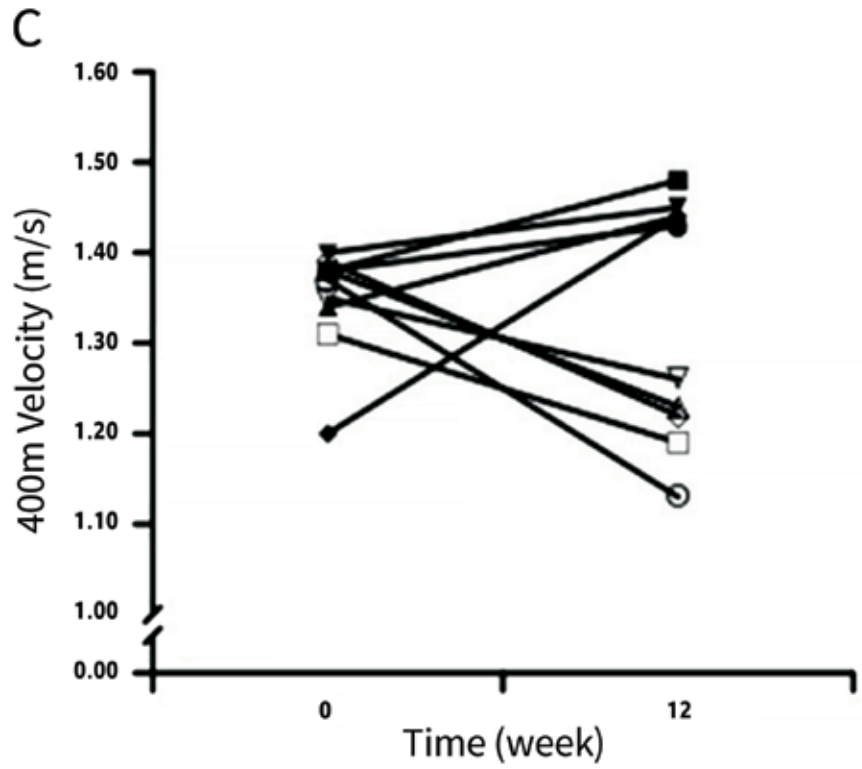
"High body fat does not mean high body weight, leanness is not the same thing as thinness, and a higher body weight may be a very good thing if it is the result of more lean mass that can improve strength-to-weight ratio (Bernadot, 2007). The coach who insists that his/her athlete loses five pounds may be dismayed at the performance outcome if that weight comes from muscle and not fat. This same athlete who gained five pounds of muscle and lost five pounds of fat would be the same weight but with a better strength-to-weight ratio… put simply, the failure of many physically active people to optimally consume fluid and energy may be the direct result of using an inappropriate metric, weight, as the sole measure of performance readiness. It also may be due to a misunderstanding of energy thermodynamics as it relates to humans" (p. 3) (Bernadot, 2013).

It's easy to see how misguided articles about "ideal racing weight" (and instructions by coaches to lose arbitrary amounts of weight) are potentially hazardous. It is also critical to examine what energy restriction does to body composition. Athletes restricting caloric intake or maintaining LEA often do so to lose weight and optimize performance. However, research connects LEA to a decrease of lean muscle mass and increase in fat mass, the opposite of the desired effect for athletes (Bernadot, 2007). When a person has LEA, their body responds to protect vital survival functions and reduce energy expenditure (Stellingwerff, 2020). It makes sense evolutionarily that the body suppresses reproductive function when EA is low; pregnancy requires a lot of energy. Reduction in energy expended at rest, resting metabolic rate, is also correlated with LEA (Mountjoy et al, 2014). And, with LEA the body converts muscle (which requires energy output to maintain), in favor of energy reserves (fat) (Bernadot, 2007). Unfortunately, this change in body composition can signal to an athlete with ED that their caloric restriction is insufficient, which may lead them to push deeper into LEA through increased exercise or further intake restriction (Bernadot, 2007).

The connection between weight and performance is nuanced. Weight loss may lead to either positive or negative performance changes, without considering the psychological and physiological impacts of weight-based pressure and RED-S. Using weight and body composition as KPIs require very close monitoring by trained sports scientists and dieticians to execute effectively while keeping energy in balance. Getting it wrong can cause devastating impacts. An interview of 11 U.S. Collegiate track and field coaches suggested coaches place a high level of importance on weight for performance, but also recognize it as a primary indicator of EDs/DE, creating a challenging contradiction (Plateau et al, 2014). If reducing weight does not guarantee improving performance, and coaches have so many other options at their disposal to improve fitness through training (especially at the HS/College level), why is it such a focal point?

The lack of awareness of the impact of LEA among coaches, medical professionals and athletes is well documented

FIGURE 3: TIME TRIAL PERFORMANCE CHANGES BY MENSTRUAL STATUS, CYCLIC (BLACK/ FILLED-IN MARKERS) VS. OVARIAN SUPPRESSED (WHITE/OPEN MARKERS) (VANHEEST ET AL, 2014)



(Mountjoy et al, 2018). Under 50% of coaches and medical professionals could correctly identify the 3 components of the triad, including only 37% in a survey of 931 U.S. physicians, and 19% in a survey of 370 U.S. HS nurses (Mountjoy et al, 2018). A 2014 study of 170 HS female athletes found only 28% knew amenorrhea (3 consecutive months without menstruation) was not a normal response to playing sports, 24% knew stress fractures occur more often in girls with amenorrhea, and 49% knew that not eating enough could cause them to lose their period (Brown et al, 2014). We have failed to properly educate athletes and their care providers on the impacts of the female athlete triad – even though we've known about it for almost 30 years (Nazem and Ackerman, 2012) – which has led us to a situation where many athletes and coaches promote nutritional decisions that are detrimental to health and performance. As a new concept, awareness of RED-S is presumably lower.

IDENTIFYING RED-S IN HIGH SCHOOL/ COLLEGE SETTINGS

There are many barriers to identifying RED-S, particularly for scholastic coaches. Clinical methods for establishing RED-S, such as hormonal testing, body composition scanning, metabolic testing, etc. are not available to most coaches, and should only be conducted by trained medical professionals. Visual assessments of changes in body composition are used by many college coaches to identify DE/ED, but those are subjective, vulnerable to second guessing, may be hidden by the athlete (e.g. wearing baggy clothes), and are imperfect (an athlete may appear to have increased fat mass, which may suggest that their energy intake is adequate, but may also indicate RED-S) (Plateau et al, 2014). Coaches "sometimes have difficulty distinguishing between athletes whose appearance or body composition metrics meets their sport-type expectations (e.g., thin) from those with an eating disorder, especially if the athlete's performance is good" (Plateau et al, 2014). Figure 4 provides a guide for signs that coaches may see in an athlete that could indicate RED-S.

For female athletes, amenorrhea is a clinical sign of LEA and a problem that needs to be addressed immediately. Even missing 1-2 periods is reason for follow-up (Stellingwerff, 2020). Many coaches, particularly male coaches of female athletes, may feel uncomfortable discussing menstruation. This stigma must change to protect athlete health. Coaches need to facilitate education on the importance of regular menstruation and share resources available to athletes if they experience menstrual dysfunction. While the menstrual cycle is a helpful way of identifying RED-S, it is not perfect. First, it excludes male athletes; second, it is not a valid indicator if the athlete uses hormonal contraception; third, it relies on self-reporting, which may be a problem if an athlete wants to conceal an ED. For male athletes, low testosterone is likely connected to LEA, which manifests in a reduced sex drive (Mountjoy et al, 2018).

Another indicator of RED-S is bone health. Athletes who experience multiple stress fractures should seek further evaluation for RED-S. Figure 5 illustrates differences in bone injury frequency for athletes with LEA indicators. Athletes with amenorrhea or low testosterone were more likely to have a history of multiple stress fractures, and eumenorrheic athletes (or those with normal testosterone) were more likely to never have had a stress fracture.

Another barrier to identifying RED-S is that athletes experiencing eating disorders may attempt to hide them. Retrospective surveys have shown athletes took significant steps to conceal DE, and denied to themselves and to others that they were experiencing problems (Vandereycken and Humbeeck, 2008). Athletes reported that confrontation about a potential ED only led them to become defensive and entrenched in their denial, and educational materials were not effective because athletes didn't apply signs of ED to themselves (Vandereycken et al, 2008). Educational materials that present RED-S indicators non-judgmentally – and that emphasize a person may be in LEA without an ED/DE – may help bridge the gap for people who struggle to accept their condition. Broadening the view of impacted people and reducing the stigma around RED-S may help athletes see symptoms in themselves.

Surveys such as the Low Energy Availability in Females Questionnaire (LEAF-Q) have been validated for iden-

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FIGURE 4: SIGNS OF LOW ENERGY AVAILABILITY (20' MARK) (STELLINGWERFF, 2020)

Poor Energy Availability - Secondary Indicators

Key things to look out for:
(the more items identified, the greater the risk for poor EA - items in red every coach can help to identify)

- Dietary restriction, all the way to eating disorders.
- Constantly striving to be thin year-round.
- Body mass index <17.5 or >5% BW loss in a month.
- <9 menses in last 12 month
- > 2 or more career stress fractures
- BMD Z score <-1.0 (if you have this data)
- Very inconsistent training (ups and downs)
- High levels of fatigue (sleeping a lot)
- Drop off in training and/or competition performance
- Poor sex drive (or low measured sex hormones)

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tifying athletes with LEA (Melin et al, 2014). In a large survey study on female athletes (age 15-30), Ackerman et al used two survey methods combined with self-reported history of ED/DE to identify athletes with LEA. They found athletes identified as potentially LEA by surveys had increased risk of: menstrual dysfunction, poor bone health, metabolic issues, hematological detriments, psychological disorders, cardiovascular impairment and gastrointestinal dysfunction (Ackerman et al, 2018). LEA athletes were also associated with decreased training response, impaired judgment, decreased coordination, decreased concentration, irritability, depression and decreased endurance performance (Ackerman et al, 2018). This suggests that survey methods are potentially a viable method to screen for RED-S, and should be developed for both sexes and implemented in high school and college athletic settings, ideally under supervision of qualified medical personnel.

WHAT CAN COACHES DO?

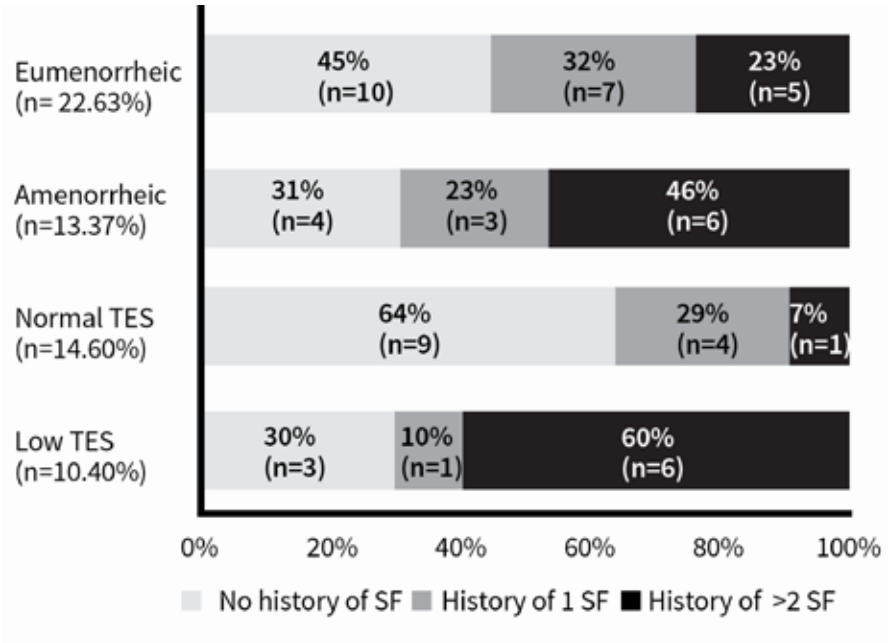
It can be difficult for a coach, who does not have complete access to information surrounding an athlete's dietary decisions, to identify and address RED-S. Understanding the myriad potential markers of RED-S expands the warning signs that a coach can identify and improves early awareness and intervention. Any treatment for DE or ED should be primarily the responsibility of appropriately trained registered dieticians, psychologists and medical providers. However, we cannot ignore the role of coaches as members of the treatment team. Coaches are uniquely positioned to identify early signs of LEA in their athletes; they see athletes daily and can be in tune to performance and behavioral indicators of RED-S. Coaches are also an important connection hub for all members of an athlete's support network, such as medical professionals, teammates, family and administrators. With appropriate education and tools, coaches can play a key role in preventing RED-S.

The first thing coaches can do is stop talking about weight as a pathway to improved performance. Numerous studies have demonstrated that coach comments about weight (even if they are not intended to be negative) are likely to increase instances of DE/ED and weight insecurity (McMahon and Dinan-Thompson, 2011; Sundgot-Borgen et al, 2013). A 2013 study also makes this clear: "athletes are more at risk for disordered eating if they believe it is possible to enhance their sports performance through weight regulation" (Krentz & Warchburger, 2013). Stories of athletes experiencing negative treatment from coaches around weight continue to emerge in track and field, suggesting that these unhealthy coaching practices remain prevalent at all levels of XC/TF. Rather than perpetuating incorrect beliefs, college and HS coaches should be actively working against cultures of "weight optimization." There are so many variables we can influence that will help a person find their own optimal body composition and improve performance, while empowering them to feel strong and fit. Leave conversations about weight to medical providers or registered dieticians.

Coaches should educate athletes about the warning signs of RED-S, provide a pathway to seek professional help with concerns about their own EA status, and state clearly that they value health and wellbeing above all else. The onus is ultimately on the athlete to use the information and seek assistance, which may not always overcome their cognitive dissonance (Vandereycken et al, 2008). However, a coach can send important signals about team values, help destigmatize insecurities surrounding body image, and debunk myths about sport performance. This may also help break down stigma for female athletes surrounding menstruation.

More broadly, coaches should think about how interactions with student-

FIGURE 5: RED-S MARKERS AND STRESS FRACTURE HISTORY IN ELITE ENDURANCE ATHLETES TES = TESTOSTERONE (HEIKURA ET AL, 2018)



athletes impact insecurities about body image and fueling. There are well-documented two-way connections between mental health and disordered eating (Mountjoy et al, 2014). Coaches may focus exclusively on physical development, and therefore overlook connections between the psychological and physiological that impact performance and wellbeing (Plateau et al, 2014). Strict "disciplinary" styles of coaching may reduce the likelihood that an athlete will feel comfortable disclosing issues or concerns (McMahon et al, 2012), which backs up Biesecker and Martz' research in 1999 that showed negative coaching styles "could create increased vulnerability for body image and eating problems." In a longitudinal survey of 122 athletes, the one explanatory variable that predicted eating psychopathology was "perceived levels of interpersonal conflict with a coach" (Shanmugam et al, 2014).

Facilitating open dialogue with athletes about all aspects of training and wellbeing is a critical step towards enabling them to feel valued as team members. Rather than trying to micromanage athletes, coaches should find ways to give them ownership over their training and performance. Research has shown that when coaches promote autonomy, feelings of competence, and value as a person rather than an athlete, it may help improve athletes' overall wellbeing (Reinboth et al, 2004), which may reduce their risk for DE (Shanmugam et al, 2012). Fostering an environment of trust and open communication, and valuing athletes holistically, may help overcome the difficulty of acknowledging and accepting DE behavior and lead towards treatment.

Improving the security of coach-athlete relationships (as opposed to facilitating anxious/dependent attachment), and asserting that value within a team, extends beyond performance and is suggested to promote positive self-esteem and eating habits (Shanmugam et al, 2012; 2014). This is not mutually exclusive with striving for competitive performance. Nothing presented here precludes maximizing performance. What I am suggesting is that coach-athlete relationships should extend beyond the nuts and bolts of training. Positive, affirming coaching styles can generate better health and wellbeing outcomes, reduce the likelihood of developing DE and RED-S, and ultimately improve performance outcomes. We shouldn't be waiting for RED-S to become a problem; we can proactively address the underlying challenges with our teams and create a culture where it is less likely to occur.

Finally, coaches need more education on RED-S. As a coaching community in track and field, we must expand coaches' education opportunities on RED-S and provide resources for spreading knowledge to athlete populations at all levels. It can be challenging and intimidating to tackle this problem, which is pervasive in our sport. It can be exceptionally hard to initiate these conversations, particularly if previous work hasn't been done to form positive, trusting relationships, or if an athlete is performing well in the short term (Plateau et al, 2014). This fear and lack of knowledge means coaches often fail to notice or address problems that, in retrospect, seem obvious. It is tempting as a coach to place blame on the individual in these situations, but we need to acknowledge the role that we play in perpetuating cultures of weight-insecurity (Plateau et al, 2014).

Countless athletes have had their health and wellbeing permanently damaged through their participation in college and HS XC/TF. Countless athletes have failed to meet their potential or burned out of sport because of harmful, false narratives surrounding weight and performance. We need more research on the effects of RED-S and best practices for coaches to promote adequate energy availability. We need more education available on how to handle these difficult situations. We need to empower coaches to fill their potential as positive influencers on eating culture and "first responders" to RED-S. There's great work being done globally by many coaches and researchers. Now is the time to build on it and expand access to information so that it can be put into practice at all levels of our sport.

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Decision-Making for a New Facility

MARY HELEN SPRECHER

You are ready to build a new track and field facility – that is the great news. As you will soon discover, that venue will be a pleasure to use and a showpiece for your school, as well as a great way to attract student athletes to try out for teams.

So…where do you start in order to get it built? Because many coaches and athletic directors are not accustomed to starting from scratch, the actual jumping-off point may be unclear. After all, coaches and ADs may have seen improvements and upgrades during their watch, but the construction of a whole new facility? That might be unfamiliar territory. And while it is tempting to turn to the Internet for ideas on what to do next, it is perhaps not the best option. Instead, here are some best practices:

Arm yourself with reliable, impartial information: The American Sports Builders Association (ASBA), the trade association for those in the athletic facility design, construction and supply profession, has two books that will help lead you through the process: Running Tracks: A Construction and Maintenance Manual, and Sports Fields: A Construction and Maintenance Manual. Both are available through ASBA's website, www.sportsbuilders.org. The books are written in user-friendly terms and describe everything from the decision-making process through construction and into the ongoing maintenance of facilities.

Know it will take more than one meeting. Know that this is going to be a multi-faceted process, necessitating decision-making on multiple levels. For example, just at the outset, you will need to set the following goals:

• Setting a budget
• Selecting a planning team
• Defining the project
• Identifying the sports to be incorporated (A 400-meter track can encircle a field, but what types of sports will be hosted on that field – football, soccer, field hockey, lacrosse, rugby or others? Will there be field events like shot put and discus, or will these be located outside the confines of the venue? The specific sports to be played and the total number of events may influence the choice of natural grass or synthetic turf, the necessary equipment to be included, the size and orientation of various fields or play areas, the amount and location of spectator seating, the choice of markings and numerous other aspects of the design.)
• Choosing a suitable site
• Regulatory compliance
• Developing a site plan
• Designing individual components of the overall plan
• Selecting a surface or surfaces, accessories and amenities
• Creating a comprehensive master schedule
• Determine spectator expectations
• Identifying community expectations regarding access
• Identify available utilities
• Developing specifications

…and that is before a shovel ever goes into the ground. It is important for you to have regular meetings with your project team members. Try to recall that as with any project, the more groundwork you can lay in advance, the more efficient design and construction will be.

You will need a steering committee. This might be made up of the following:

• Coaches of sports that will use the facility
• Athletic Director
• School administrators
• One or more student athletes

A word of caution about the steering committee: At the outset, there may be a lot of interest from parents, community members and others. Try to keep the committee to a manageable size – and let it be known that all steering committee members will need to be on board for the entire project. In some cases, there might be those who volunteer to be members but only because they have specific interests – the playing surface, the sports that should be hosted, the ability for the community to use the facility – but little interest in the project as a whole. Try to just keep the more knowledgeable, more committed people as your base. An overly large committee filled with people who really do not have the big picture in mind will not be in the best interest of the school or the project.

So what do you do with people who have one interest only? It is okay to let them know the committee has adequate staffing but that you are still interested in what they have to say. Simply ask them to write letters (or e-mails) in support of their views and note that you will consider them when the time comes for decision-making on those subjects.

Try not to get bogged down in details that will be decided upon later. Someone is always going to want to talk about the excruciating details of the track colors, logos on the field, Wi-Fi, mobile apps, the scoreboard or placement of sponsorship logos. That will become important – just not right now. Try to keep discussions on track.

Finding the right partners is a priority. If there are some new facilities in your district or region, ask the ADs about the builders they worked with. When you get a list of possible companies, vet them:

• What is your experience in building track and field projects?
• How many years have you been doing it, and how many projects have you completed?
• Is there an ASBA Certified Track Builder and/or an ASBA Certified Field Builder on staff?
• Can we get a list of references? (Remember that one sample reference will not tell the whole story, but a list of projects and of contacts will give you a better picture)
• Do you perform all of your own work or do you use subcontractors?
• What are your company's strengths?
• Which projects can I visit? (Look for a range of facilities and take some time to walk through all of them)

The intended use of the project requires forward-looking decision-making. We mentioned earlier the need to identify the activities the project will host. However, taking that to the next level, consider the following:

• Will the venue host training or competition – or do you hope it will? For example, do you anticipate a football field that will host regular games – or do you want it to host state, regional or national championships, even if your school is not playing in them? Your answers here will impact your spectator facilities as well as amenities such as restrooms, concession stands and parking.
• Will you be hosting events for athletes with physical or developmental challenges? If so, you will want to build in more ADA-compliant parking spaces and spectator facilities than the baseline that is recommended.
• What about non-athletic uses? What kind of events will be hosted at the facility when it is not being used for athletic events? Will local 5Ks or other events be held on the track? Do you plan to use any of the fields for graduation, concerts, festivals or similar activities? What form or forms of field protection will be required? How much turnaround time is available between uses?
• At what level will sports be played? This will impact the size of the facility as well as the national governing body whose guidelines will come into play. If a field will host multiple sports, it must be built to the standards of the governing body for the sport(s) requiring the largest possible space. For example, if a field will host football (which has a standard length of 360' and a standard width of 160'), as well as field hockey (300' long and 180' wide), the field must be, as a minimum, large enough to satisfy the standard length for football and the standard width for hockey. (Note: Dimensions are set by the governing bodies for sports at various levels; always check to make sure you are working with the most up-to-date set of rules prior to beginning construction or marking). For very high-level competition, provision should be made for media coverage, including camera positions, announcers and press facilities. Special lighting will be required for televised events.
• Remember that the level of use will delineate other decisions – lighting level and placement of fixtures, for example,

are both sports-dependent and will need to be addressed at the outset of the project. Lighting will also have to be checked for compliance with any local codes regarding light spill or trespass.

Private use (school only, in other words) vs. community use is an important decision. It will be essential to note at the outset whether the gates of the facility are locked when practices or competitions are not taking place, or whether local residents can run on the track or work out on the field when the facility is not in use. There is no one perfect answer; however, the facility, unless someone is available to watch it 24/7, will be at risk for misuse if it is always open to the public. What kind of security do you have, and can someone be devoted to watching the track and field facility?

Keeping an eye on your budget is essential. It is easy to say you need everything to be top-of-the-line – until you hit the bottom line of the estimate. If you have a touch of sticker shock, the pros advise asking the contractor what can be trimmed without affecting overall quality and user experience:

• The most important construction features (and those that should never be cut back or done cheaply) are drainage and base construction. Despite the fact that they are invisible to the end user, these features will ensure the longevity of the structure. The success or failure of your facility rests on these two items, so take them off the table when considering cutbacks.

• Going with the lowest possible bidder is not always the best solution. Seek out knowledgeable professionals and understand that you are going to be paying for knowledge and integrity – and that the end product will show it.

• If you want to make cost cuts, there are places to do it. Aspects of the projects might be built later if it does not compromise the overall quality and use of the facility.

• Reconsider the maintenance items

that might come at a high initial cost, such as landing pit sand catchers or hard covers with surfacing. Ballasted mesh fabric covers on precast or poured-in-place concrete can yield big savings.

• In another example, there are several different types of running track surfaces that have a wide cost range. You should select a surface that fits your needs, but this is one area where you can economize.

If you want to avoid sticker shock in the first place, work with your contractor, provide the budget and ask them to work backwards from that. It is the best way to stay on target with your final figure.

Expect to devote a lot of time to the choice of a surface. Your track and field facility is going to be a place athletes and coaches spend a lot of time, and the surfaces they are on (both the track and the field) will need to be decided upon. And while it is wrong to make sweeping pronouncements on a brand, or even a type, of surfacing, there are certain factors to take into consideration:

• Your budget: Perhaps the most essential factor to bring into play, your choice of a surface will impact your budget. However, since many other questions will affect this, we will include them as well…

• Your maintenance abilities (and budget): We will not lie to you here: synthetic fields are less work because they lack the need for mowing, fertilization and the like. However, they are not maintenance-free, and the construction will come at a different price. What is the budget for maintenance? What is your staff 's training? Do you have enough staff? Realistically, what can the staff do, and what must be contracted out? Expert and diligent maintenance is necessary to extend the useful life of all playing surfaces, no matter what type of surface you are using. Can you afford the required level of maintenance while providing a reserve for eventual replacement?

• User preference: This will come into play as well. You (or someone) might prefer a specific track or field surface, and that is perfectly fine. Additionally, there might be a local vendor – a sod farm, a turf manufacturer, etc. who has done a lot of work in your area and to whom the local community is loyal. A good decision will balance all these considerations.

• Scheduling Field Use: To what degree does the owner or the field management staff control the schedule of field use? How long is the sport or sports season? Is there an off season? How long between events is available for maintenance, repair, refurbishing? How many other fields are available? What is their condition? The degree to which the owner or management staff can schedule or limit the use of the field may affect surface choices.

• What are the local weather conditions – such as freeze/thaw or minimum/maximum temperatures – and will the field be used during times of the year where temperatures, precipitation and/or drought are extreme? How much does it rain – not enough, enough or too much? How soon must the field be available for play after rain? Are there local restrictions on use of water for irrigation? Any of these factors may affect the choice of surface.

Remember that surface is only one choice. It might be one that takes a lot of discussion, and it might be one that parents, athletes and the community want to involve themselves in. However, this is a decision that should be made by your steering committee as a whole and not by one group with a specific interest. (If people who are not on the committee have strong preferences, ask that those be sent in e-mail or letter form, for consideration during the decision-making process).

The duration of construction can be a moving target. It is, after all, largely weather-dependent, with some materials, such as concrete, needing to cure, and other vendors needing to be in place. In some cases, it may be three to four months from the time the first shovel hits the ground, whereas in others, it may be significantly more – or even less, depending upon the scope of the project.

While building a track and field facility requires some multilayered decision making on the back end, the good news is that each of these questions feeds into the whole, resulting in a more user-friendly facility that becomes as much of a marketing piece for the school as it is for the athletes themselves (who want to be seen by college coaches). The decisions you make in advance will make a good facility even better.

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