YEAR-ROUND STRENGTH TRAINING FOR COLLEGIATE FEMALE CROSS COUNTRY RUNNERS—SAMPLE PROGRAM

DAVID GRANATO, MS, CSCS

Strength training is an often neglected aspect of training for distance athletes. Female athletes especially are often reluctant to participate in strength training, and coaches are hesitant to include it into their overall program design. However, it is an important component to success in cross country racing.

Cross country running, for female National Collegiate Athletic Association (NCAA) Division I and II athletes, is characterized by races of 5,000 or 6,000 meters, over a variety of surfaces, such as grass, sand, and dirt, and also includes uneven terrain and hills. Races can last anywhere from 16 to 22 minutes, depending on the level of the athlete, and the length and difficulty of the course.

Strength training is especially important for female athletes, as they are at a greater risk of overuse injuries, compared to male athletes (12). The Naval health research center has found that lower extremity weight training is negatively correlated with incidences of stress fractures in females (5), and other research has specifically shown that significantly stronger hip abductors, and greater external rotation strength result in a lower overall injury rate (7). The purpose of this article is to outline the guiding principles of a suggested strength training program for female cross country runners, in order to reduce the incidence of injury. Reducing the incidence of injury will result in longer periods of un-interrupted sport specific training, with the result of improved racing performance.

PHYSIOLOGICAL ADAPTATIONS

The main physiological adaptations expected to occur as a result of a strength training program are anatomical adaptations, mainly the strengthening of the musculature and connective tissue. There will also be neurological adaptations, especially for athletes that have not lifted before (3). A greater number of motor units will be recruited and at a faster rate (3). Stored adenosine triphosphate (ATP) might also increase slightly. Ligament strength, tendon strength, and collagen content will all increase (3).

TRAINING PHASES AND GOALS

NCAA female distance runners, in addition to the cross country season, will also compete in indoor and outdoor track. This three sport format, with three separate and distinct championship seasons, necessitates a three peak per year system. The annual plan should be built around this schedule, and planning should work backwards from the championship segments.

As part of a year round training program, the year has been divided into three phases, which are repeated throughout the year, as well as six sub-phases, which are also repeated throughout the year. The 52-week plan is made up of nineteen mesocycles, each consisting of anywhere from two to five one-week microcycles. See Table 1 for a visual representation of this 52-week plan.

TABLE 1. SAMPLE 52-WEEK ANNUAL PLAN

PHASES	PREPARATORY I											
Sub Phases	General Prep								Specific Prep			
Mesocycles	1				2				3			
Microcycles	1	2	3	4	5	6	7	8	9	10	11	12
Competitions												

PHASES	COMPETITIVE I											
Sub Phases	Pre-Competitive					Competitive					Peaking	
Mesocycles	4					5					6	
Microcycles	13	14	15	16	17	18	19	20	21	22	23	24
Competitions	Cross Country 5k			Cross Country 6k		Cross Country 5k		Conference 6k		Regionals 6k		Nationals 6k

PHASES	TRANSITION I		PREPARATORY II					
Sub Phases	Transition		General Prep		Specific Prep			
Mesocycles	7		8		9			
Microcycles	25	26	27	28	29	30	31	32
Competitions								

PHASES	COMPETITIVE II									PREP III		
Sub Phases	Pre-Competitive		Competitive							Peaking	General Prep	Specific Prep
Mesocycles	10		11			12				13	14	15
Microcycles	33	34	35	36	37	38	39	40	41	42	43	44
Competitions				3000		Husky Invite 5k		Conference Mile		Indoor Nationals 5k		

PHASES	COMPETITIVE III						TRANSITION II		
Sub Phases	Pre-Competitive		Competitive				Peaking		Transition
Mesocycles	16		17				18		19
Microcycles	45	46	47	48	49	50	51	52	53
Competitions	1500		Mt. Sac 10k			Conference 5k		Outdoor Nationals 10k	

During each of the general prep phases, anatomical adaptations will occur as the athlete is re-introduced to strength training. Training is slowly increased in frequency and intensity, allowing adaptation. The main objective of this phase is to prepare the muscles, ligaments, tendons and skeleton to handle the intensity of the training to follow. The strength training program should focus on the abdominal muscles, the lower back, the muscles along the spinal column, as well as the hips, with a secondary focus on the legs for cross country athletes. Additionally, this is the time to address and correct any imbalances that might exist between agonist and antagonist muscle groups, which could result in injuries (6). The goal is to involve all muscle groups in a program that includes multi-joint exercises, as well as increase the volume of work athletes are able to effectively handle. Especially in untrained athletes, a greater volume of training has been shown to increase strength (11).

Following the general prep phase is the specific prep phase. In this phase, repetitions are reduced and intensity is increased, as well as exercises being adjusted to increase sport specificity.

During the pre-competitive and competitive phases, the goal is to maintain the strength gains that were made during the general and specific prep phases. During this phase, strength training should not be increased, and can even be decreased at times. However, frequency should be maintained so that de-training does not occur.

During the peaking phase, strength training is reduced or eliminated altogether. This allows the athlete to compete at the highest level with minimal fatigue from training, but this phase can only last for a few weeks before de-training occurs. Determining the duration of the taper is one of the most important, as well as most challenging, aspects of exercise prescription. According to research by an expert on tapering, Inigo Mujika, a 14-day taper seems to be the longest a taper can last for distance runners, without any adverse effect on performance (10).

During the transition phase, following the peak competition of the season, the goal is to mentally and physically recover, as well as slowly reintroduce strength training at a lower frequency, and intensity than what was done during the season.

THE ANNUAL PLAN

The annual plan used by the author is laid out as follows; training begins each summer with a long preparatory phase for the cross country season. The prep phase consists of an eight-week general prep sub phase, and a four-week specific prep sub phase. These phases take place in June, July, and August. The preparatory phase is followed by a five-week pre-competitive phase, starting in September and progressing into October. Starting in October, there is a four-week competitive phase, during which the bulk of the regular season races occur. Finally, there is a three-week peaking phase, which includes the two most important meets of the cross country season, the regional and national championships. This peak is followed by a two-week transition phase.

Following the cross country season, two weeks of general prep training are done before the start of the indoor pre-competitive phase, followed by four weeks of specific prep. These phases occur starting in December and into January. There is then a two-week pre-competitive phase in the middle of January. The competitive phase starts at the end of January when the students return for spring semester, and lasts six weeks. There is a short peaking phase, lasting one week in March for the indoor national championships, followed by two weeks of specific prep for the outdoor track season.

To start the outdoor season, there is a two-week pre-competitive phase, which is followed by a four-week competitive phase. This is followed by a two-week peaking phase with the goal of the athlete having their best performance of the track season at the outdoor national championships at the end of May.

Following the third peak of the year, there is a one-week transition phase to allow for physical and mental recovery, before the 52-week program starts again.

NEEDS ANALYSIS

A needs analysis should be conducted on an individual basis to highlight specific needs, deficiencies, and weakness that an individual athlete might have that could result in injury. Given the outcome of the individual needs analysis, a strength coach can create, or modify, a program to best suit the needs of that athlete. However there are some common things that all female cross country runners can benefit from.

Running is a single leg sport, requiring the athlete to strike the ground with one leg, while the other goes through a swing phase. This foot-strike results in an immediate eccentric contraction, followed by a concentric contraction where the runner puts force into the ground to propel themselves forward. In cross country races, this often occurs in uneven terrain that can cause different steps to occur in different planes and ranges of motion, as well as soft surfaces that do not return as much energy as is put into them.

Running utilizes every muscle in the lower body, as well as the hips and core for forward propulsion, or stabilization. The physiological needs are for muscular endurance, as well as the oxidative and glycolytic energy systems in order to compete effectively for distances between 5,000 and 6,000 meters.

EXERCISE SELECTION

Exercise selection should be based on what the needs analysis showed to be the requirements of the sport, as well as the available equipment. The exercises are divided into primary exercises, secondary exercises, and assistance exercises. Primary exercises are the exercises that form the basis of the program. The

primary exercises selected all focus on large or multiple muscle groups, and are multi-joint movements. Secondary exercises are exercise that are not primary exercises, but are important to the training goals because they strengthen or activate antagonist muscle groups. Assistance exercises focus on small muscle groups, and usually only involve one joint. Assistance exercises are mostly used to rehab a previous injury or to correct an imbalance or concern that could cause an injury in the future. These exercise can and should be individualized to the specific needs of each athlete. The exercises chosen should include movement patterns, and a range of motion, in excess of typical running movement pattern and range of motion.

TRAINING LOAD, REPETITIONS, AND VOLUME

Training load, repetitions and volume will be determined by the goals of the program as well as the phase of the program. Based on the author's experience, the following are recommended training loads, repetitions, and volume.

During the general prep phase, when the focus is on anatomical adaptations as well as learning the proper technique and methods for the exercises, the best strategy we found was light weight and higher repetitions. This will allow the desired anatomical adaptations to take place as well as offer a safe and easy way for athletes to learn exercises. During this phase for the primary exercises, 3 sets of 12 – 15 repetitions are utilized, at approximately 65% of an estimated one-repetition maximum (1RM). During the general prep phase, when the goal is to increase strength, the weight is increased and a repetition/set scheme of 3 x 8 – 10 at approximately 75% of 1RM was used.

TABLE 2. TRAINING FOCUS FOR GENERAL PREP PHASE

PERIOD	GENERAL PREP PHASE
Goal	Hypertrophy/Endurance and Basic Strength
Intensity	Low to moderate 65 – 75% 1RM
Volume	High to moderate 3 sets 8 – 15 repetitions
Frequency	2x per week

During the specific prep phase, the repetition/set scheme was 3 x 6 – 8 at approximately 80 – 85% of 1RM.

TABLE 3. TRAINING FOCUS FOR SPECIFIC PREP PHASE

PERIOD	SPECIFIC PREP PHASE
Goal	Basic Strength
Intensity	Moderate 80 – 85% 1RM
Volume	High to moderate 3 sets 6 – 8 repetitions
Frequency	2x per week

During the pre-competitive phase, the repetition/set scheme undulates between 3 x 6 – 8 at 80% of 1RM, and 3 x 10 – 12 at 65 – 70% of 1RM to maintain strength gains, without being so tiring as to take away from the focus of the training program.

TABLE 4. TRAINING FOCUS FOR PRE-COMPETITIVE PHASE

PERIOD	PRE-COMPETITIVE PHASE
Goal	Strength/Maintenance
Intensity	High to moderate 65 – 80% 1RM
Volume	High to moderate 3 sets 6 – 12 repetitions
Frequency	2x per week

During the competitive phase, the repetition/set scheme undulates between 3 x 6 – 8 at 80% of 1RM, and 3 x 10 – 12 at 65 – 70% of 1RM to maintain strength gains as well. However, frequency is reduced during certain weeks, to once per week, to accommodate the competition schedule.

TABLE 5. TRAINING FOCUS FOR COMPETITIVE PHASE

PERIOD	COMPETITIVE PHASE
Goal	Maintenance
Intensity	High to moderate 65 – 80% 1RM
Volume	High to moderate 3 sets 6 – 12 repetitions
Frequency	1 – 2x per week

During the peaking phase, the repetition/set scheme is 3 x 6 – 8 at 80% of 1RM; however, only 1 – 2 sets are performed, and the frequency is reduced to once per week to maintain strength gains.

TABLE 6. TRAINING FOCUS FOR PEAKING PHASE

PERIOD	PEAKING PHASE
Goal	Maintenance
Intensity	Moderate 80% 1RM
Volume	Moderate 1 – 2 sets 6 – 8 repetitions
Frequency	1x per week

PRIMARY EXERCISES

The primary exercises utilized throughout the program include the Turkish get-up, split squat, walking lunges, and bench step overs.

The Turkish get-up was selected because it is a full body exercise that utilizes nearly every muscle group. It is also a complex, multi-joint exercise. The Turkish get-up, when used properly, activates all the abdominal and core support musculature around the spine, as well as the hips, shoulders, and legs (8).

The split squat was selected because it is a leg and hip strengthening exercise that also activates the core and spinal musculature. The split squat also mimics the single-leg balance aspect of running. The increased range of motion and increased resistance means that the split squat is sport specific to running.

The walking lunge was selected because it is a leg and hip strengthening exercise that also activates the core and spinal musculature. The walking lunge also mimics the single-leg balance aspect of running, as well as the need to smoothly transition from one leg to the other. The increased range of motion, and increased resistance beyond what is required for running, means that the walking lunge is sport specific.

The bench step over is a hip/leg exercise, and activates the abdominal and spinal musculature. The bench step over is performed with a medicine ball held above the head, maintaining straight arms. The athlete steps over the bench forward leading with the right leg. The athlete then turns 90 degrees right, and executes a side step over the bench, again leading with the right leg. While facing the same direction, the athlete then side steps back over the bench, leading with the left leg. This is followed by a 90 degree right turn and another forward step over the bench, this time leading with the left leg. This constitutes one repetition.

The Turkish get-up and bench step over are both full body movements that occur in multiple planes, involve complex movement patterns, and require stability with overhead weight. For this reason, these have been selected as the primary exercises for each session. All of the primary exercises were selected because of their similarity to the running motion and the specific demands of cross country running.

SECONDARY EXERCISES

The secondary exercises utilized throughout this program include Romanian deadlifts (RDL), glute bridges, and assisted pull-ups.

The RDL was selected because it is a leg and hip extension strengthening exercise that also utilizes the core and spinal musculature. The RDL also focuses on the glutes, hamstrings, and lower back which are antagonistic muscle groups to the running motion.

The assisted pull-up was selected because it increases strength of the arms, trapezius, and latissimus dorsi, which, along with the spinal and lower back muscles are important to posture and pelvic stabilization. They should be assisted because very few female cross country athletes are able to perform unassisted pull-ups.

The secondary exercises were selected because of their complementary nature to the core exercises, and strengthening of antagonistic muscle groups to those usually used in running. It is important to strengthen these muscle groups so that injuries do not occur due to strength imbalances.

ASSISTANCE EXERCISES

The author recommends a variety of assistance exercises be utilized in any program targeting distance runners. It is recommended that different athletes be assigned different assistance exercises based on their individual and specific needs. Recommended assistance exercises include: planks, dynamic planks, Russian twists, monster walks, glute bridges, inch worms, band side steps, clam shells, and leg curls.

Planks, dynamic planks, inch worms, and the Russian twist were all selected as exercises to strengthen the abdominal, spinal, and postural musculature, especially in a manner similar to the demands placed on them by cross country running.

Monster walks, band side steps, clam shells, and leg curls were selected as assistance exercises because they activate and utilize the glute muscles, strengthen hip extensors and knee flexors, as well as utilizing lower body movement patterns in a manner not usually used in running. The main focus of these assistance exercises is either core/postural strength or glute/hip activation and strengthening. Increased hip abduction and external rotation strength has been shown to negatively correlate with patellofemoral joint pain (4), so assistance exercises should also be chosen to address this.

TRAINING FREQUENCY

During the training year, the training frequency utilized by this program is twice per week, immediately following sport-specific running training of either a VO_2max interval training

session or anaerobic threshold training session. On the weeks of important races or during the pre-competitive and competitive phases, frequency of strength training is reduced to once per week, to allow for additional rest prior to competition. During the peaking phase, which only lasts up to 14 days, frequency can remain at once per week, with a reduction in volume, while maintaining intensity.

REST PERIOD

The rest period between exercises is determined by the goals of the training session. Given the goals of a strength training program for female cross country athletes, sets of the primary, or secondary, exercise will be alternated with sets of the paired assistance exercise.

STRETCHING/WARM-UP

The purpose of the warm-up should be to activate the gluteal and hamstring muscles, and exaggerate the running form. This warm-up should aid in increasing dynamic mobility, proprioception, and connective tissue strength. Static stretching should not be used, due to research showing that it is not as effective as a dynamic warm-up, and can reduce power and agility performance (9).

This warm-up should be performed prior to all lifts. An example warm-up can start with leg swings, front to back and side to side, followed by unweighted lunges with a trunk twist, and then high knees and butt kicks. These can be followed by a simple hurdle mobility workout consisting of stepping over hurdles with opposite legs, alternating over and under hurdles, and lateral step overs. Following this simple dynamic warm-up, the athletes will move to the weight room and begin the lifts.

TESTS AND EVALUATIONS

In the author's experience, given the nature of the strength training program, the goals, as well as the infrequent nature of the lifts, it is more important to spend the time on the actual lifts, rather than on weight room testing and evaluation. Proper loads can be found through trial and error, and the experience of the coach, favoring lifting lighter rather than heavier, and focusing on instruction of proper form and technique. This is especially true with those new to the program, and new to resistance training in general, as many female cross country runners often are. The goal of the strength training session is to provide a basis for injury free running, rather than improving specific weight room performance; therefore, no tests or evaluations are required. However, if performed properly, with experienced athletes, testing does allow for better load selection and potential prevention of injury by avoiding too heavy of loads. This is up to the discretion of the coach, and the allowed time. Testing should never be done during the competitive or peaking phases because there is a risk of impeding sport performance.

TAKEAWAY

The main purpose of this strength training program is to avoid injury. Avoiding injury will allow the athlete to spend more uninterrupted time on sport-specific training, as well as be able to handle a higher volume and intensity of sport-specific training. In a sport not based in strength or power, but rather energy system development, strength training should be supportive without hindering the sport-specific training necessary for success.

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TABLE 7. SAMPLE GENERAL PREP WORKOUT

Phase: Preparatory I
Sub Phase: General Prep
Macrocycle: 1
Microcycle: 1

DAY 1	WT	REPS
Turkish Get-Up	10	x 15
	10	x 15
	10	x 15
Dynamic Plank *In between sets of Turkish Get-Up*	30 s	
Walking Lunge	25	x 15
	25	x 15
	25	x 15
Glute Bridge	30 s	

Phase: Preparatory I
Sub Phase: General Prep
Macrocycle: 1
Microcycle: 1

DAY 2	WT	REPS
Bench Step Over	10	x 15
	10	x 15
	10	x 15
Russian Twist with Medicine Ball *In between sets of Bench Step Over*	5 lb	30 s
Split Squat	50	x 15
	50	x 15
	50	x 15
Clam Shell with Light Band	3	x 10

TABLE 8. SAMPLE SPECIFIC PREP WORKOUT

Phase: Preparatory I
Sub Phase: Specific Prep
Macrocycle: 3
Microcycle: 12

DAY 1	WT	REPS
Turkish Get-Up	30	x 6
	30	x 6
	30	x 6
Assisted Pull-Up *In between sets of Turkish Get-Up*	6 6 6	
Dynamic Plank *In between sets of Split Squat*	30 s	
Split Squat	85	x 6
	85	x 6
	85	x 6
Glute Bridge	45 s	

Phase: Preparatory I
Sub Phase: Specific Prep
Macrocycle: 3
Microcycle: 12

DAY 2	WT	REPS
Bench Step Over	30	x 6
	30	x 6
	30	x 6
Russian Twist with Medicine Ball *In between sets of Bench Step Over*	10 lb	30 s
RDL	85	x 6
	95	x 6
	100	x 6
Walking Lunge	65	x 6
	65	x 6
	65	x 6
Clam Shell with Medium Band	3	x 10

TABLE 9. SAMPLE PRE-COMPETITIVE WORKOUT

Phase: Competitive I
Sub Phase: Pre-Competitive
Macrocycle: 4
Microcycle: 14

DAY 1	WT	REPS
Turkish Get-Up	25	x 8 – 10
	25	x 8 – 10
	25	x 8 – 10
Assisted Pull-Up *In between sets of Turkish Get-Up*		8
		8
		8
Dynamic Plank *In between sets of Split Squat*		45 s
Split Squat	55	x 8 – 10
	55	x 8 – 10
	55	x 8 – 10
Glute Bridge		60 s

Phase: Competitive I
Sub Phase: Pre-Competitive
Macrocycle: 4
Microcycle: 14

DAY 2	WT	REPS
Bench Step Over	25	x 8 – 10
	25	x 8 – 10
	25	x 8 – 10
Russian Twist with Medicine Ball *In between sets of Bench Step Over*	15 lb	30 s
RDL	75	x 8 – 10
	80	x 8 – 10
	85	x 8 – 10
Walking Lunge	80	x 8 – 10
	80	x 8 – 10
	80	x 8 – 10
Clam Shell with Medium Band	3	x 10

TABLE 10. SAMPLE COMPETITIVE WORKOUT

Phase: Competitive I
Sub Phase: Competitive
Macrocycle: 5
Microcycle: 19

DAY 1	WT	REPS
Turkish Get-Up	25	x 10 – 12
	25	x 10 – 12
	25	x 10 – 12
Planks *In between sets of Turkish Get-Up*		60 s
Assisted Pull-Up *In between sets of Walking Lunge*		8
		9
		10
Walking Lunge	55	x 10 – 12
	55	x 10 – 12
	55	x 10 – 12
Band Side Step with Medium Band	3	x 10

Phase: Competitive I
Sub Phase: Competitive
Macrocycle: 5
Microcycle: 19

DAY 2	WT	REPS
Bench Step Over	25	x 10 – 12
	25	x 10 – 12
	25	x 10 – 12
Inch Worms *In between sets of Bench Step Over*	3	x 15
RDL	80	x 8 – 10
	85	x 8 – 10
	90	x 8 – 10
Split Squat	80	x 10 – 12
	80	x 10 – 12
	80	x 10 – 12
Monster Walks with Medium Band	3	x 10

TABLE 11. SAMPLE PEAKING WORKOUT

Phase: Competitive I
Sub Phase: Peaking
Macrocycle: 6
Microcycle: 24

DAY 1	WT	REPS
Turkish Get-Up	30	x 6
	35	x 6
Dynamic Plank *In between sets of Turkish Get-Up*	45 s	
Walking Lunge	65	x 6
	70	x 6
Glute Bridge	35 s	

Phase: Competitive I
Sub Phase: Peaking
Macrocycle: 6
Microcycle: 24

DAY 2	WT	REPS
No Day 2		

TABLE 12. SAMPLE TRANSITION WORKOUT

Phase: Transition I
Sub Phase: Transition
Macrocycle: 7
Microcycle: 26

DAY 1	WT	REPS
Turkish Get-Up	15	x 15
Plank *In between sets of Turkish Get-Up*	60 s	
Walking Lunge	30	x 15
Band Side Step with Light Band	3	x 10

Phase: Transition I
Sub Phase: Transition
Macrocycle: 7
Microcycle: 26

DAY 2	WT	REPS
Bench Step Over	15	x 15
Inch Worms *In between sets of Bench Step Over*	3	x 15
Split Squat	55	x 15
Monster Walks with Medium Band	3	x 10

ABOUT THE AUTHOR

David Granato is currently the Assistant Coach and Recruiting Coordinator for the men's and women's cross country and track and field programs at Adams State University. Working primarily with distance and mid-distance runners, he has helped lead seven national championship teams, and 17 individual national champions. He holds a Master of Science degree from Adams State.

CONFLICT OF INTEREST STATEMENT

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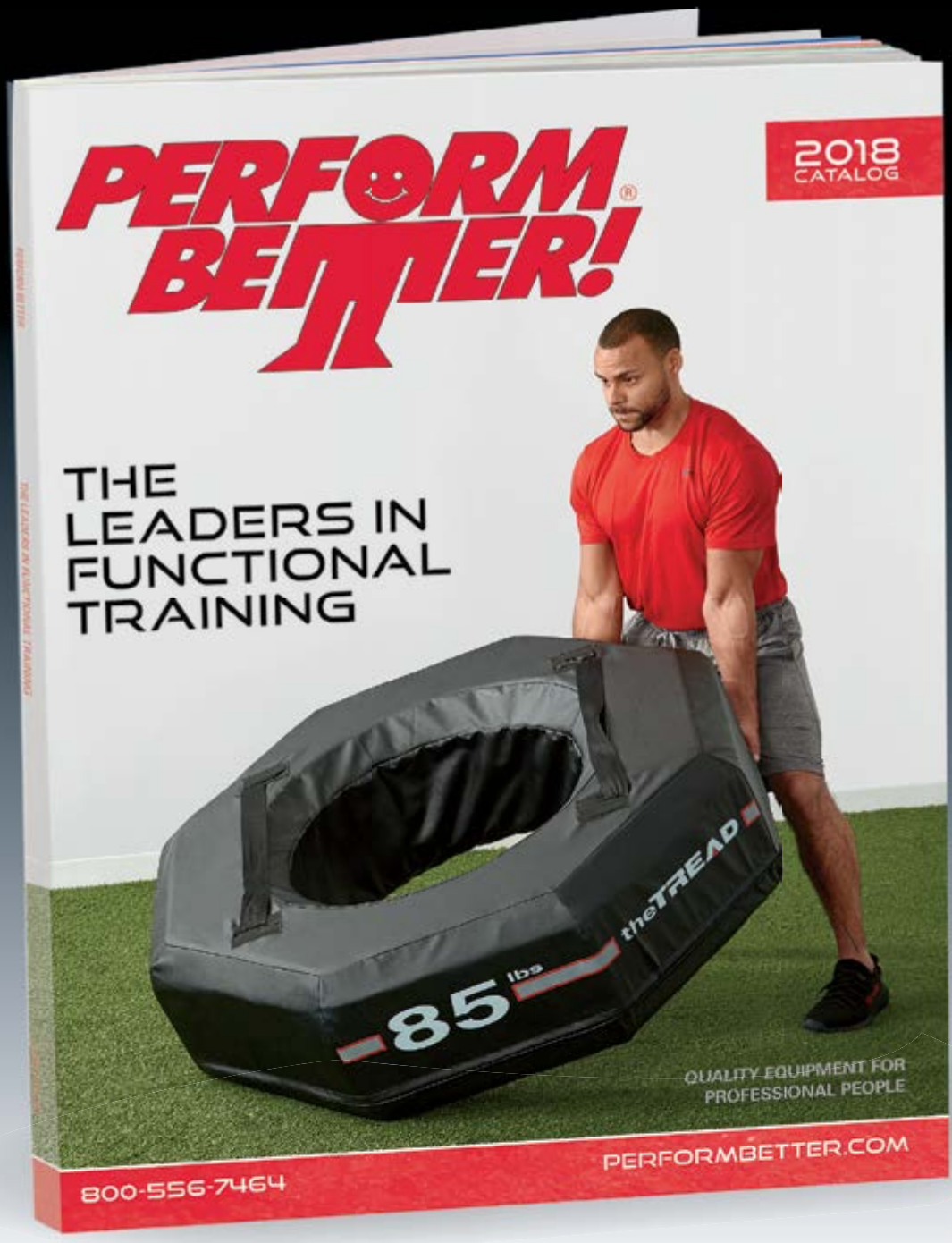

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