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NEWS

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MOVING TOWARD THE FUTURE

By Deborah Riebe, Ph.D., FACSM
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Over the past two years, there have been significant changes made to the ACSM Health Fitness Specialist (HFS) certification.

These changes are important in professionalizing the field of exercise science and confirming that individuals with HFS certification are qualified to prescribe exercise to healthy populations, those with controlled disease, and other special populations. The certification committee has been guided by ACSM HFS certified professionals in making these changes. Many of you participated in focus groups or online surveys that helped inform the committee as to which new directions to pursue. In fact, the response to our online surveys was overwhelming and far exceeded our expectations. The committee would like to sincerely thank those who helped us move the certification in a new exciting direction.

So, what's new? As most of you know, the name of the certification was changed from Health Fitness Instructor to Health Fitness Specialist. Your feedback made it clear that the word "instructor" no longer reflected your job responsibilities. The HFS Committee and the Committee for Certification and Registry Boards (CCRB) spend countless hours considering and debating the merits of various potential new names. Input was provided from various stakeholders in the fitness industry and by the surveys that were completed by ACSM certified individuals. The word "specialist" was overwhelmingly recommended to us by both groups, and we proceeded with the formal procedure required to change the name of the certification.

On July 1, 2011, the eligibility requirements for becoming HFS certified will change. Starting on that date, an individual will need a bachelor's degree in an exercise-based program to be eligible to take the exam. Currently, the eligibility requirements are an associate's degree in a health related program. After consideration of the scope of practice of the HFS, careful deliberation, and feedback from surveys and a public comment period, the change was recommended and ultimately approved by the ACSM CCRB. Those of you who are already certified but do not meet the new eligibility criteria will retain your certification.

Individuals wishing to take this certification after July 1, 2011 will need to have a bachelor's degree in Kinesiology, Exercise Science or other exercise-based degree. Certification candidates must have course work in anatomy, physiology, and a minimum of 18 credits in exercise science course work including courses in exercise physiology, biomechanics (kinesiology), exercise prescription, and fitness testing.

Finally, the HFS Committee has spent the last year and a half completing a job task analysis and rewriting and redesigning the current knowledge, skills and abilities (KSAs). The KSAs will become knowledge and skills (KSs). The new task statements will better reflect the duties and responsibilities that most HFS perform on a regular basis.

Members of the HFS Committee are excited about the future of the certification. We hope these changes will help the profession continue to grow and mature and that HFS certified individuals remain at the forefront of the profession.

Resistance Training Intensity

Research and Rationale

BY PETER MAGYARI, PH.D., HFS, CSCS

THE USE OF RESISTANCE TRAINING (RT) ACTIVITIES TO ADDRESS PARAMETERS OF HEALTH, FITNESS, AND PERFORMANCE HAS BEEN ENDORSED BY MANY MAJOR HEALTH ORGANIZATIONS.[3]

Therefore, RT activities are being incorporated in nearly all comprehensive exercise programs. While most health and fitness professionals recognize the acute program variables utilized in RT activities (sets, reps, intensity/load, volume, rest, exercise selection, exercise order, etc.), the rationale behind proper implementation of these variables is sometimes clouded by exposure to articles published in the popular press and online media. It is paramount that exercise professionals utilize evidence based practice in the design of their clients' exercise programs. This article will give the reader a more comprehensive background of one of the most important and often misunderstood RT variables, intensity.

The amount of resistance or load utilized in RT program design has traditionally been referred to as training "intensity." In keeping with the terminology used for aerobic exercise where intensity was defined as a percentage of a person's maximal oxygen uptake or maximal heart rate, intensity in RT exercise was often defined as a percentage of a person's one repetition maximum (1RM). A 1RM is defined as "the maximal amount of weight that can be lifted through the full range of motion, for one repetition, with proper form." For example, if the maximal weight that a client can lift on the bench press (through the full range of motion, with proper form) is 220 lbs, then this is the client's 1RM for the bench press. The client might then be given an exercise program that recommends one or more sets with intensity or load set at 80% of the client's 1RM. In this example, the load would be calculated by multiplying the 1RM (220 lbs) by the prescribed intensity 80% (0.80) with the resulting product being ≈ 175 lbs.

Table 1. The maximal number of repetitions achieved at 80% of 1RM on select exercises of machine weightlifting (Universal Gym).

	Bench Press	Arm Curl	Leg Press	Leg Curl
Men Trained	12.2	11.4	19.4	7.2
Men Untrained	9.8	7.5	15.2	6.3
Women Trained	14.3	6.9	22.4	5.3
Women Untrained	10.3	5.9	11.9	5.9

Adapted from reference 5.

Intensity is alternately defined in RT as a targeted repetition number or repetition range per set. For example, the client may be given an exercise program that recommends an intensity or load whereby substantial effort is needed to complete 10 repetitions per set. There is an inverse relationship between the number of repetitions that can be performed and the percent 1RM that is assigned. While several tables have been published that estimate the number of repetitions which can be completed at a given percent of 1RM, the exercise professional should be aware that these estimates are impacted by subject age, sex, training status, size of the muscle group, genetics, machine or free weight, and movement biomechanics.[2, 6, 7, 8] Therefore, a standard intensity of 80% 1RM (which typically yields 8-12 RM on the bench press) may produce as few as 5 RM in the leg curl exercise and as many as 20RM in the leg press exercise.[6] Table 1 summarizes the differences in the number of maximal repetitions which were performed by either trained or untrained men and women on two upper and two lower body machine exercises.[5] This information highlights a common misconception among exercise professionals that subjects should be able to complete a standard number of repetitions, across a variety of exercises, if a specific % 1RM is

prescribed. Therefore, if a percent of 1RM is utilized to prescribe intensity, one should not expect a constant number of repetitions per set for all exercises and if a specific repetition range is prescribed per set, then one should not assume that this represents a constant percent of 1RM.

It is important that exercise professionals recognize the interaction between intensity and volume when determining the number of sets of each exercise to be performed. Exercise intensities set at a high percentage of 1RM result in fewer repetitions and, therefore, lower volume of work per set. Exercise intensities set at a low percentage of 1 RM result in higher repetitions and higher volume of work per set. To illustrate this point let's look at three different 1RM exercise intensities (93%, 83%, and 65%) and their resulting volume-load (weight lifted multiplied by the number of repetitions completed) when performed to volitional fatigue. Using a standard repetition chart for the bench press exercise for trained men we can estimate corresponding repetitions to be (3, 7, and 15 respectively)[2] Table 2 displays the resulting volume-load at these three intensities and the number of sets required, at each intensity, to reach a volume-load of 2,000 lbs.

A review of Table 2 illustrates that to obtain a volume-load similar to that obtained with one set of low intensity RT (65% 1RM), three or more sets of high intensity RT (93% 1RM) must be completed. Therefore, intensity should always be considered when determining the number of sets prescribed per exercise with higher intensity programs always requiring multiple sets.

Table 2. Number of sets required at different RT intensities based on an arbitrary volume-load of 2,000 lbs.

Intensity (%1RM)	Load (lbs)	Estimated repetitions	Volume-load (lbs) (load X repetitions)	sets
93	205	3	615	>3
83	183	7	1281	2
65	143	15	2145	1

Traditional RT intensity paradigms for muscular strength, hypertrophy, and endurance place muscular strength at high intensity (≥ 85% 1RM) and low repetitions (≤ 6 RM) and muscular endurance at low intensity (≤ 65% 1RM) and high repetitions (≥ 15 RM) with muscle hypertrophy spanning the intensity range from low to high (65%-85% 1RM) and the repetition range from 6 to 15.[4] The latest ACSM RT Position Stand offers some evidenced based recommendations for prescribing RT intensity for novice, intermediate, and advanced lifters seeking to improve muscular strength, hypertrophy, or endurance.[1] These recommendations are summarized below:

Strength

- Novice and Intermediate: 60%-70% 1RM for 8-12 repetitions
- Novice: 1-3 sets per exercise
- Advanced: 80%-100% 1RM

Hypertrophy

- Novice and Intermediate: 70%-85% 1RM for 8-12 repetitions for 1-3 sets per exercise

† Advanced: 70%-100% 1RM for 1-12 repetitions for 3-6 sets per exercise with the majority of training devoted to 6-12 RM

Endurance

- Novice and Intermediate: Relatively light loads (10-15 repetitions)

† Advanced: various loading strategies 10-25 repetitions or more for multiple sets

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• *National Heart, Lung, and Blood Institute evidence category A. Evidence is from outcomes of random controlled trials with rich body of evidence.*

† *National Heart, Lung, and Blood Institute evidence category C. Evidence is from outcomes of uncontrolled trials or observations.*

Based on the above recommendations, a strong body of evidence suggests that RT prescriptions for novice and intermediate lifters should focus on 1-3 sets of 8-12 repetitions for each major muscle group. This prescription should provide a positive adaptive response in regard to muscular strength, hypertrophy, and to a lesser extent endurance. There is a strong body of evidence that suggests higher RT intensities (80%-100% 1RM) should be prescribed to elicit strength adaptations in advanced strength athletes. There also is support for using a variety of training loads to maximize muscular strength.[1] It has been demonstrated that adding a high volume, low intensity set to several low volume, high intensity sets increases both size and strength gains when compared to low volume, high intensity training alone.[5] Other recommendations made in the latest ACSM RT Position Stand (marked with a † above) are not supported by a rich body of scientific data and should be viewed in this context.[1]

About the Author

Peter M Magyari, PhD, HFS, CSCS is the Exercise Science Program Director in the Brooks College of Health at the University of North Florida. He earned a PhD in Exercise Physiology from University of Florida working under the direction of Dr Michael Pollock and Dr Randy Braith. His primary research interests are in the application of resistance training programs in health, disease, and sport.

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PIRIFORMIS SYNDROME | A Real Pain in the Butt

BY JEFFREY S. HARRISON, CSCS, NSCA-CPT

It is estimated that 15% to 20% of the U.S. population experiences low back pain annually, and that at any given time, 2% of the population is disabled because of back problems.[1] Historically, low back symptoms have been the second leading cause of office visits to primary care physicians and the most common reason for visits to osteopathic physicians.[2] However, back pain is not always a result of a weak or deconditioned low back. Tight hamstrings, an anterior pelvic tilt, and weak abdominals can all contribute to low back discomfort oftentimes mistaken for low back pain. With a sedentary society that spends countless hours sitting at their desks, driving their cars, or lounging on the couch, a posterior discomfort known as piriformis syndrome can appear and is a real pain in the butt.

Anatomy

The piriformis muscle (Figure 1) is a flat, oblique shaped muscle that lies deep to the gluteal muscles. It originates from the sacral spine and attaches to the greater trochanter of the femur, functioning as both an external rotator and abductor of the thigh. Piriformis syndrome is characterized by a localized spasming and tightening of the piriformis muscle, sometimes causing symptoms associated with sciatica due to the fact that the sciatic nerve runs proximally and in some individuals, through the piriformis muscle.

Diagnosis

Often mistaken or confused with sciatica, piriformis syndrome has been a controversial diagnosis since its initial description in 1928.[5] Even today, piriformis syndrome remains controversial because, in most cases the diagnosis is purely clinical, and there is no test specific to piriformis syndrome to support the clinical findings. Given the lack of agreement on exactly how to diagnose piriformis syndrome, estimates of the frequency of sciatica caused by piriformis syndrome vary from rare to approximately 6% of sciatica cases seen in a general family practice.[6]

The condition occurs when the piriformis muscle becomes tight or spasms which can sometimes compress or irritate the sciatic nerve. Clients who suffer from piriformis syndrome generally complain of a deep, tooth-ache like – pain or numbness in the buttocks. It also can cause a tingling in the lower back and a radiating sensation down the back of the hamstring. Functional biomechanical deficits associated with piriformis syndrome may include the following:

- Tight piriformis muscle
- Tight hip external rotators and adductors
- Hip abductor weakness
- Decreased lower lumbar spine mobility
- Sacroiliac joint inflammation
- Anatomic variations in either piriformis muscle or sciatic nerve anatomy

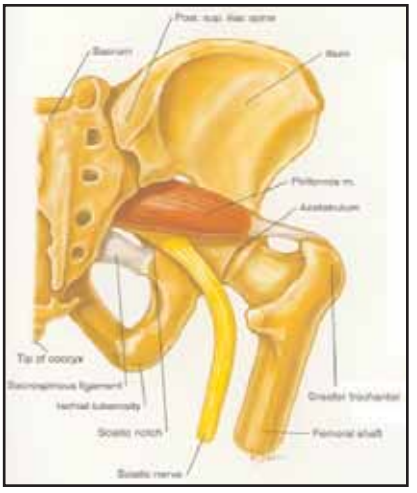

Figure 1

In the real world, the condition is generally the result of excessive sitting, poor gait mechanics, poor posture, sedentary lifestyle, and standing with one's weight primarily distributed on one leg. In the gym or sports setting, piriformis syndrome is often the result of exercising on hard surfaces or on uneven ground; exercising in worn out or ill fitting shoes; increasing exercise intensity or duration too quickly; walking or running with the toes pointed out; excessive or improperly executed squat and stair climbing techniques; sports that require change of direction; and excessive hill running. Furthermore, the incidence of piriformis syndrome has been reported to be six times more prevalent in females than males.[4]

Treatment

Piriformis syndrome is diagnosed primarily on the basis of symptoms or a physical exam, and although there are no tests that accurately confirm the diagnosis, X-rays, MRI, and nerve conduction tests may be necessary to exclude other causes. In most circumstances of piriformis syndrome, an inflammatory response is suspected in the muscle and/or sciatic nerve. Therefore, the treatment goals are directed initially toward decreasing inflammation, associated pain, and spasm, if present. Treatment options may include rest, cryotherapy, gentle pain-free stretching exercises, and electrical modalities.[3] Despite this fact, there are numerous, non-surgical, non-pharmacological, treatment strategies that exist for clients with this condition, with stretching and massage being the most common. Below are a few stretches that most people with piriformis syndrome can do at home, at the gym, or even at work. Individuals whose pain worsens with any of these exercises should stop them immediately. Those that may be unsure whether these stretches are safe for their particular situation should check with their physician or therapist before attempting these movements. Furthermore, exercise professionals should refer their clients whose symptoms are refractory to all previous management and treatment options to their physician for follow-up care.

Piriformis Stretch – Seated

1. Sitting on a chair, cross leg of affected side across top of opposite leg at a 90° angle
2. Lean forward at the waist, bringing the chest towards the crossed leg
3. Hold stretch for 15 sec up to 1 min

Piriformis Stretch – Supine (Figure 2)

1. Lying on back with both knees bent, cross affected leg at a 90° angle across opposite knee
2. Grasp the "under" leg with both hands and pull the knee towards the chest until the stretch is felt in the buttocks and hips.
3. Hold stretch for 15 sec up to 1 min

Figure 2

Piriformis Pigeon Pose Stretch (Figure 3)

1. Lie face down and bend affected leg under stomach at a 90° angle and opposite leg straight back
2. Lean towards the ground and allow body weight to add pressure to stretch
3. Hold stretch for 15 sec up to 1 min

Figure 3

Prevention

There is no definitive way to prevent piriformis syndrome from occurring, but much can be done to reduce its likelihood. These include but are not limited to:

- Teaching the benefits of sitting less or how to sit properly.
- Reinforcing correct posture with weight evenly distributed between both feet.
- Educating clients on the importance of wearing properly fitted shoes for exercise and/or athletics.
- Stressing the importance of proper warm-up before any sustained physical activity.
- Strengthening and conditioning the muscles of the hips, glutes, low back, and upper thighs with exercises such as supine glute/hip raises, side lying clam shells, or stability ball wall squats.

The damaging effects of a sedentary lifestyle cannot be emphasized enough. An active lifestyle while beneficial can have negative ramifications, as well. Piriformis syndrome can affect an individual's lifestyle, as well as their activity level. Through proper diagnosis, treatment and prevention, it can be remedied and kicked in the butt.

About the Author

Jeffrey S. Harrison has been a fitness professional for more than 15 years, working with hundreds of clients from all walks of life. He also is a published writer with articles appearing in fitness journals and local publications. Jeff earned his degree in Exercise and Sport Science from Penn State University and is nationally certified through the NSCA and ACE.

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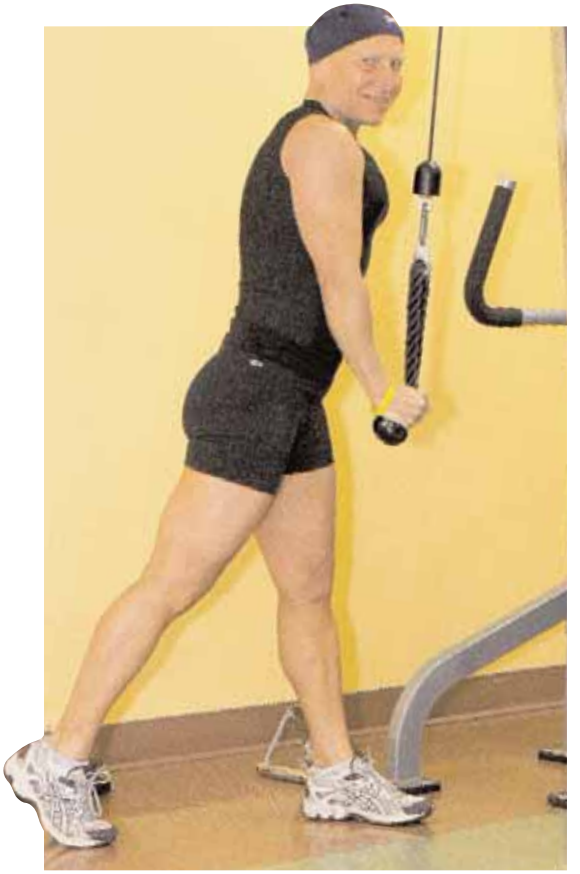
Additional Resource

Boyajian-O'Neil LA, McClain RL, Coleman MK and Thomas PP. Diagnosis and management of piriformis syndrome: An osteopathic approach. Journal of the American Osteopathic Association. 108(11):657-664, 2008.

EXERCISE AS ADJUVANT THERAPY FOR CANCER

BY JONATHAN K. EHRMAN, PH.D., FACSM



Used with permission: photo by Cynthia Jasper-Parisey

Evidence regarding the benefits of exercise training in reducing the risk of primary development of cancer is now well established. However, there are over 11 million people in the U.S. who have undergone or are undergoing treatment for cancer.[1] We are just beginning to scratch the surface on the role exercise might play in individuals with cancer with respect to effect on treatment and secondary prevention. Today it is recognized that for many individuals cancer is a chronic disease, and often these people continue the "treatment" or management of their cancer throughout their lifetime. With this there is an evolving focus on the cancer survivorship period with respect to: 1) living cancer free, 2) managing ongoing cancer treatment, 3) reducing the risk of developing other diseases secondary to cancer treatment, and 4) optimizing quality of life.

Exercise and physical activity are being rapidly incorporated into the core of cancer survivorship programs. In response to this trend, the American College of Sports Medicine (ACSM) teamed with the American Cancer Society to develop the Cancer Exercise Trainer certification (www.acsm.org/cet). ACSM provides exercise information for the patient with cancer in chapter 27 of *ACSM's Exercise Management for Persons with Chronic Diseases and Disabilities*, third edition. Also, ACSM recently published a Roundtable Consensus Statement on exercise guidelines for cancer survivors. In addition to the positive effects exercise training has on quality of life measures in patients with cancer, there is an accumulating foundation of research describing the positive effects of exercise training on a variety of related clinical conditions. Many of these are listed in the table.

Table: Common Conditions Associated with Cancer and the Response to Exercise Training

CLINICAL CONDITIONS	RESPONSE TO EXERCISE TRAINING
• Reduced functional capacity	• Improvements in cardiorespiratory endurance[5]
• Fatigue	• Less reported fatigue[7]
• Nausea	• Reduced nausea[13]
• Obesity	• Better weight control[6]
• Loss of muscle	• Preserved muscle mass[6]
• Compromised immunity	• Increased number of natural killer cells[14]
• Increased risk of lymphedema	• Reduced symptoms of lymphedema[15]

Currently lacking is an in-depth understanding of the effect of exercise training in those in the survivorship stage on 1) the effectiveness of cancer treatment, 2) the likelihood of cancer remission, and 3) the impact on risk factors of other chronic conditions/diseases (*e.g.*, cardiovascular disease, diabetes, hypertension, obesity, etc.) that may result from cancer treatment. The following is a brief comment on what we know about exercise training and each of these topics.

Exercise and Cancer Treatment Effectiveness

Much of the research on exercise training performed during cancer treatment comes from single-site studies.[10] And much of this research has been conducted in patients with breast cancer. Other than improvements in fitness and psychological factors, which can help to alleviate symptoms during cancer treatment, little else is known about the effect of exercise training on cancer treatment.[10] For instance, does exercise affect the efficacy of cancer treatment? In the only study we know of addressing exercise effects on treatment, Cournyea, *et al.*[5] reported that breast cancer patients completed more of their planned chemotherapy regimen if they performed resistance training than if they performed aerobic exercise or usual care. Although yet to be replicated, this data suggests that more research is warranted to assess the role that exercise may play in improving chemotherapy completion rates. Depending on future findings, this has the potential to positively affect treatment outcome.

Variables that may interact with exercise and cancer treatment effectiveness include the stage and type of cancer and the type of treatment.

Another potential aspect is the acute effect on immune function. Studies with small numbers of subjects demonstrate either no change, or an improvement in biomarkers of immune function in those who perform low to moderate intensity aerobic and/or resistance exercise.[8] These types of responses may result in more beneficial decisions about whether to administer chemotherapy on a given day versus holding treatment until conditions are more favorable. In addition to immune response, chronic fatigue also may affect cancer treatment administration decisions. The latter stages of a radiation therapy regimen and the period immediately following each chemotherapy treatment are typically when fatigue peaks. The level of fatigue experienced will vary based on factors such as the type of treatment, and the age and general health of the individual. Careful monitoring of daily fatigue and maintaining or reducing, versus increasing, exercise intensity may be necessary to avoid excessive fatigue.

Exercise and Cancer Remission

Since physical activity is strongly related to the primary prevention of breast and colon cancer, and evidence is accumulating strength for other types of cancer,[9] it is reasonable to suggest that exercise may play a role in prolonging the remission stage. However, little data is available. Irwin *et al.*[11] reported findings from a prospective observational study in women previously diagnosed and treated for breast cancer and found a positive relationship between moderate-intensity physical activity levels (~9 MET-hours/week) performed up to two years after diagnosis, and prognosis. This was observed in both women who were active before their cancer diagnosis and in those who began regular exercise only after their diagnosis. Others report a 60% lower risk of death following a colon cancer diagnosis in those who were moderately active.[12] Clearly much more work needs to be performed before this question is fully answered, but the early data appears promising.

Exercise and Cancer Treatment Related Chronic Conditions

Various cancer treatment regimens increase the risk of non-cancer related chronic diseases. For instance, up to 60% of women with breast cancer gain weight during adjuvant treatment.[6] And more than 50% of men undergoing long-term androgen deprivation therapy for prostate cancer will develop metabolic syndrome or increase the number of cardio-metabolic risk factors associated with metabolic syndrome.[3] Also, it is suggested that if body mass index (BMI) is >30 kg/m^2 there is a two-fold greater risk for cancer recurrence.[2, 4] In each of these examples, the risk of cardiovascular disease, obesity, diabetes and hypertension are increased. Exercise may play a role in combating these changes; but to date prospective randomized trials have not been conducted.

The accumulating evidence is that patients diagnosed with cancer can benefit in many ways beyond typical quality of life improvements when they perform regular exercise training. More evidence is needed to assess the mechanisms involved and if the improvements cited extend to all types of patients and cancers. Currently, when prescribing exercise for patients with cancer, the texts *ACSM's Exercise Management for Persons with Chronic Diseases and Disabilities* (3rd ed.), *ACSM's Guidelines for Exercise Testing and Prescription* (8th ed.), and *ACSM's Resources for Clinical Exercise Physiology* (2nd ed.) are adequate resources to address topics such as when in the course of diagnosis and treatment to begin exercise, what the exercise intensity should be, and what clinical issues are relevant to evaluate during exercise.

About the Author

Jonathan K. Ehrman, Ph.D., FACSM, PD, CES is the associate program director of preventive cardiology at Henry Ford Hospital, Detroit MI. He also is the director of the hospital's Clinical Weight Management Program. He has served on ACSM's Committee of Certification and Registry Board since 2000 and was chair of the Clinical Exercise Specialist Committee. He also is the senior editor of the 6th edition of *ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription* and is the umbrella editor for the next editions (2013 release date) of the ACSM certification texts.

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COACHING NEWS:

WHAT DRIVES YOUR CLIENTS TO BE WELL

By Margaret Moore (Coach Meg), MBA

The results our clients get from fitness training or wellness coaching are not just a higher level of health, fitness, and well-being. They also include change: change in behavior, thinking, and feeling. Yet, change is not always easy. A critical ingredient is potent and lasting motivation that comes from within and is based on immediate benefits or long-term rewards.

To be human is to be ambivalent about changing something that one has struggled with for years or even decades, whether it is learning how to fully relax, loving to exercise regularly, enjoying veggies as much as ice cream, or listening to someone you care about with undistracted, mindful presence. The amount of energy consumed by this state of chronic contemplative struggle would fuel a small car. Do I or don't I? Why can't I just get it done? Surely someone will invent THE quick fix if I wait long enough. What a loser I am for being unable to stay motivated. How come I am not driven to be fit and well?

Clients choose a "change supporter" in hiring a trainer or wellness coach in hopes of getting beyond the struggle. The rationale for this choice includes "I need someone to motivate me. I need help in staying motivated." Yet as helping professionals we need to be careful to not take on ownership and responsibility for our client's motivation. It is not our job to motivate our clients. Instead, it is our job to help our clients identify and sustain their own motivation.

In Dan Pink's new book *Drive,*[3] he talks about the importance of internal or intrinsic motivation as what truly drives or motivates us to choose to change and act on it. When the motivation to change comes from within, based on heartfelt desires, rather than via external sources, like a financial incentive or urging by one's spouse or parent, the likelihood of sustained success is dramatically improved.

"Some doors open only from the inside." — An ancient Sufi saying

There is a wonderful story in the best-selling book on flow titled *Flow: The Psychology of Optimal Experience,* written by Mihaly Czikszentmihalyi,[1] (say Cheek-sent-me-hi a few times to get it down) about a woman with severe schizophrenia in a mental hospital. Her medical team had failed to help her improve. The team decided to follow Czikszentmihalyi's protocol to identify activities in which she was motivated, engaged, and felt better. A timer went off throughout her day signaling her to complete a mini-survey on her mood, energy, engagement, etc. Her report showed that her best experience was manicuring her fingernails. So the medical team arranged for her to be trained as a manicurist. She began to offer manicures at the hospital and eventually became well enough to be discharged. She went on to live an independent life as a manicurist.

For this woman, tending to fingernails and toenails drove her well. This is an amazing story exemplifying the power of motivation when it is intrinsic. The schizophrenic woman found the task of doing manicures to be enjoyable for its own sake, with the immediate reward of a pretty result and a happy customer. It is also likely that manicuring was something she was naturally good at, tending with care to the myriad details of shaping, polishing, and painting nails. By repeating this engaging and enjoyable task over and over again, her motivation and confidence grew by leaps and bounds, allowing her to leave the protective cage of the hospital and embark upon an independent life.

The easiest way to help clients drive themselves well is to help them find activities they love to do, which use their strengths and are reinforcing, allowing them to feel better immediately or soon afterward. For example, helping a client find a way to move her body vigorously that she does not want to miss. Or supporting her efforts to discover healthy recipes that she has fun cooking. Or engage in mindfulness practices or before-bed relaxation techniques that she is good at and quickly lift the weight of the day.

Unfortunately for most of us, the activities that drive us to wellness are not intrinsically rewarding. We may never learn to love to cook healthful dinners or work out in a gym or stick to sparkling water and crudités without dip at a party.

The second most powerful source of motivation that drives human behavior is what Deci and Ryan, developers of self-determination theory, call "integrated regulation."[2] This type of motivation also comes from within, but relates to doing something because you desire its longer-term outcome, not immediate enjoyment and gratification. For example, your client gets his workouts done because they help him avoid gaining more weight. He goes to the extra effort to cook a healthful dinner to be a role model for his kids. He drinks less wine so that he feels more energetic in the morning. He lifts weights in order to build stronger bones to avoid the osteoporosis that led his grandfather to stoop.

This second-best form of motivation requires more diligent attention. Your client needs to make a mindful, conscious choice to take the more difficult path at a given moment for a payoff that is not immediate. The easy choice is beyond tempting. Warming up a pizza rather than cooking a stir-fry from scratch. Skipping the trip to the gym, even if it is in the basement, in favor of sleeping longer. Answering a few more emails even though they are not life threatening and ignoring the dumbbells next to the desk ready for a set of bicep curls or deadlifts. Your client needs to shake her brain out

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HOW OFTEN SHOULD CLIENTS PERFORM STRENGTH TRAINING?

BY WAYNE L. WESTCOTT, Ph.D.

The standard recommendation for strength training frequency is to perform resistance exercise every other day or two to three nonconsecutive days per week. It has long been recognized that everyday resistance exercise is counter-productive due to insufficient recovery time to remodel the muscle tissue that experienced microtrauma during the strength training session. While there is essentially complete consensus that clients should not strength train more often than every other day, it is not clear whether less frequent training sessions could elicit equal or even better results.

A recent research study conducted with previously sedentary subjects examined the effects of three different strength training frequencies on lean weight in 1725 men and women.[5] All of the program participants performed approximately 20 min of strength training and 20 min of aerobic activity, one, two, or three days a week for a period of 10 wk. The strength training protocol consisted of 10 standard weight stack exercises performed for one set of 8 to 12 repetitions each using a controlled movement speed and full movement range.[1]

The one day a week trainees added 0.7 pounds of lean weight, whereas both the two days a week and three days a week exercisers added 3.1 pounds of lean weight. Based on these findings, it would appear that strength training only one day a week is less effective for muscle development than performing two or three weekly resistance workouts. Another study comparing different strength training frequencies on torso rotation muscle strength had similar results.[3] The group that trained one day a week did not differ from the control subjects, whereas the groups that trained two days a week or three days a week experienced similar and significant strength gains.[3] Research by Candow and Burke also revealed similar and significant increases in both muscle strength and lean mass for exercisers who trained two or three days a week.[2]

While these findings make it tempting to conclude that two days a week and three days a week strength training programs are equally effective, it should be noted that these studies involved previously sedentary participants. In fact, a well-designed study with fit young men who regularly performed resistance exercise resulted in different outcomes.[4]

McLester and associates had the study subjects perform maximum effort strength training sessions (three sets of 10 repetitions each of eight standard weight-stack machine exercises) with varying recovery periods (24, 48, 72 or 96 hours).[4] After a one-day recovery period, strength levels were significantly below baseline. Following a two-day recovery period, strength levels were similar to (but still slightly below) baseline. After a three-day recovery period, strength levels were significantly above baseline, and remained at the same elevated level following a four-day recovery period.

These findings indicated that for advanced exercisers a one-day recovery period is clearly inadequate. Although training every other day (48 hrs rest) provided sufficient recovery time to essentially regain base-

line levels, it did not permit maximum muscle tissue remodeling. Training either every third day (72 hrs rest) or every fourth day (96 hrs rest) proved equally effective for attaining significantly increased strength levels between successive exercise sessions. The researchers did not study longer recovery periods, but it is likely that strength levels decrease towards baseline after four days of non-training.

Based on the research reviewed here, it seems clear that everyday strength training (24-hour recovery period) is counterproductive because muscle remodeling processes are incomplete. With beginning exercisers, it appears that strength training either two or three non-consecutive days a week is equally effective for increasing lean weight. Strength training one day a week results in some muscle gains, but significantly less muscle development than performing two or three weekly resistance exercise sessions.

With advanced exercisers, strength training every other day does not seem to permit sufficient recovery time for the complete cycle of muscle remodeling. This is a different response than that attained with beginning exercisers, most likely because advanced trainees perform more stressful workouts that produce more muscle tissue microtrauma. Advanced exercisers appear to require a three to four day recovery period to maximize their muscular adaptations to the strength training stimuli. It is therefore recommended that these individuals do not work the same muscles more than twice a week. For example, advanced trainees who prefer a total body strength workout could perform all of their resistance exercises on Wednesdays and Saturdays. Those who favor training different muscle groups on different days could follow a four-day split routine, such as exercising their upper body muscles on Mondays and Thursdays, and their legs/midsection muscles on Tuesdays and Fridays.

About the Author

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Coaching News *(continued from page 9)*

of automatic pilot, summon and appreciate a picture of the desired longer-term gain, and consciously choose the healthier path over the immediate craving.

It is clear from the evidence that there is not much point in your client getting off the fence and making another earnest attempt to change unless he has packed his motivational bag with activities that he loves to do for their own sake, or those he believes are can't-miss investments – leading to positive returns for health and well-being, as well as performance at home and at work.

About the Author

Margaret Moore (Coach Meg), MBA, is the Founder and CEO of Wellcoaches Corporation, a strategic partner of ACSM, widely recognized as setting a gold standard for professional coaches in healthcare. She is co-director, Institute of Coaching, at McLean Hospital/Harvard Medical School. She co-authored the ACSM-endorsed Lippincott Williams & Wilkins *Coaching Psychology Manual,* the first coaching textbook in healthcare. (www.wellcoaches.com • www.instituteofcoaching.org • www.coachmeg.com • coachmeg@wellcoaches.com)

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TRAINING FOR ALPINE ACTIVITIES AT HIGH ALTITUDE

Americans are enamored with the outdoors and it remains to this day a symbol of our American culture. From barbecues to boating, American participation in leisure sports and outdoor recreational activities has increased nearly 95% since 1995.[10] This represents 189 million participants nationwide with 48 million people participating annually in hiking and backpacking.

BY THOMAS P. MAHADY, M.S., CSCS
HACKENSACK UNIVERSITY MEDICAL CENTER

More and more people are discovering our nation's National Parks System and this has fueled American's desires to venture into more remote and challenging wilderness areas. Participation in alpinism, a broad generic term that encompasses hiking and backpacking as well as rock climbing, ice climbing and the mixing of disciplines such as technical climbing and mountaineering, has enabled Americans to successfully access areas once considered unsafe and inaccessible.[10, 12]

Participation in alpine activities also means that people are venturing into higher elevations. The impact of physical activity at altitude is dramatic. Altitude related decrements in $\dot{V}O_2$ may begin as low as 1,900 feet and continue to decline exponentially as the individual continues to gain elevation.[13] From a physiological viewpoint, "high altitude" is defined as those elevations between 5,000 and 11,500 feet above sea level with "very high altitude" defined as altitudes up to 18,000 feet.[12] Altitudes ranging from 18,000 feet to the summit of Mount Everest are considered "extreme."[12] Much of the terrain of the American west and southwest resides at elevations above 5,000 feet and attracts outdoor enthusiasts from all walks of life.

Individuals performing physical activity at elevations greater than 5,000 feet above sea level will experience acute physiological changes that will affect their performance.[13] Altitude induced decrements in arterial oxyhemoglobin saturation and maximal oxygen consumption due to the decrease in inspired atmospheric oxygen pressure result in what researchers call "oxidative stress."[2, 13]

Oxidative Stress

Oxidative stress is a term referring to the production of free radicals which are molecular fragments that contain unpaired electrons in their outer orbits.[2, 13] High intensity exercise at sea level as well as living and exercising at high altitude has been shown to increase oxidative stress. Oxidative stress may damage cellular membranes, increase cellular swelling, cause damage to the cell DNA, and induce muscle protein changes resulting in fatigue.[2, 9, 11, 13] Individuals also may experience increased symptoms associated with delayed onset muscle soreness, prolonged recovery time and an increased rate of injury. The risk of accident and/or injury increases as physical and cognitive function decrease placing the individual at great risk in high altitude environments.[13]

The potential for the development of oxidative stress increases as a product of increased workload and increased progression in elevation.[2, 6, 9, 11, 13] Physical exertion at high altitude increases heart rate, ventilation rate and cardiac output, and causes a shift in the oxygen disassociation curve. These are the body's compensatory mechanisms driven by the reduction of the partial pressure of oxygen at the alveolar level of

the lungs and a subsequent reduction of the partial pressure of oxygen in arterial blood. Tissue hypoxia and concomitant oxidative stress may still rapidly develop in spite of these compensatory mechanisms.[2, 4, 13]

As physical activity continues, the body will rely more upon anaerobic energy sources. Lactate and hydrogen ions will accumulate within the cells increasing the leakage of calcium and the acidity within the working muscles causing muscle cramping and eventually hampering physical performance.[6, 9, 11, 13] Resting at altitude will permit reoxygenation, but is limited by the reduced diffusion of oxygen across the alveolar membrane and the cycle will repeat itself once physical activity is resumed. This pattern of low oxygen levels and reoxygenation is common to alpine styled activities and is known to give rise to a cascade of free radical production.[13] Altitude induced free radical damage may have both long and short term consequences that can persist even after a return to sea level.

Aerobic Training and Conditioning

All athletes venturing into alpine related activities will benefit from improved fitness. It is impossible to predict how severely altitude will affect an individual since the responses vary among individuals at all levels of conditioning. A solid foundation of fitness will certainly improve an individual's chances for success and safety and minimize the negative effects of altitude should they arise.

Aerobic conditioning is of paramount importance since most individuals will be traveling from areas that are considered at sea level and adventuring into higher elevations with little or no time to acclimatize. These individuals will be faced with acute adaptations in a dynamic environment while working hard, sometimes up to eight hours or more per day. The goal of an aerobic endurance exercise prescription should include both maximizing the ability to succeed while minimizing the effects of oxidative stress. Aerobic endurance training increases $\dot{V}O_{2max}$ which raises the anaerobic threshold and allows for higher levels of sustained activity and faster recovery. Other adaptations and their applications to physical activity at high altitude are summarized in Table 1.

The exercise prescription for aerobic endurance training should adhere to the accepted program design variables of mode, frequency, intensity, duration and progression with an eye on maximizing lactate steady state.[1, 3, 8] Lactate steady state is defined as the exercise intensity at which maximal lactate production is equal to maximal lactate clearance and is considered by some to be a better indicator of aerobic endurance performance than maximal $\dot{V}O_2$ values.[3] This would certainly apply to the training for alpine activities at altitude and high altitude.

Aerobic Program Design

Fartlek training is well suited for alpine styled outdoor activities. The alternation of running at fast and slow speeds over both level and hilly terrains may develop all of the energy systems associated with alpine styled activities.[3, 8, 12] This method of training lacks the systematic and measurable approach of traditional exercise prescriptions and is in no way touted as a superior method of training for alpine activities. It is however an excellent adjunct to the more traditional prescriptive methods.

A systematic aerobic exercise prescription should incorporate aerobic activities at a target heart rate of 75% to 90% of maximal heart rate in order to achieve maximal lactate steady state.[3] I suggest a periodized approach over the course of sixteen weeks incorporating as much running or hiking over natural terrain as possible for an hour or more per session. Understanding that the duration of training is offset by the intensity of training, a periodized approach would accommodate the systematic manipulation of these two training variables allowing for improvement and minimizing at the same time the risks for injury and overtraining.[3, 6, 13]

Initial frequencies may begin as low as three days a week and progress up to five days a week which makes sense since alpine styled activities may challenge the individual to remain active for as many as five or more successive days.[1, 3, 8]

Table 1: Adaptations to Aerobic Training and Altitude's Effect on these Variables

Variable	Aerobic Endurance Training Adaptation	Acute Effects of Altitude on these Variables (>_5,000 feet)
Muscular endurance	Increases	Decreases
Aerobic power	Increases	Decreases
Capillary density	Increases	No change
Mitochondrial density	Increases	No change
Stored ATP	Increases	No change
Stored glycogen	Increases	No change
Stored Increases triglycerides	Increases	No change
Blood plasma	Increases	Decreases
Myoglobin	Increases	No change

References 6, 7, 8.

Resistance Training

As mentioned earlier, alpinism is a mix of outdoor disciplines that usually occur at altitudes above sea level and requires a resistance exercise prescription with a unique approach. Because alpine activities demand so much reliance upon anaerobic energy sources, the exercise prescription should emphasize heavy weights using multiple joints. Compound exercises tend to be more specific for alpine activities and are time efficient as well.[12]

In addition to performance considerations, a resistance training prescription also should consider factors for the prevention of injuries. Heavy resistance training increases the thickness and strength of tendons and ligaments making the transfer of energy more efficient while carrying extra loads (*e.g.*, backpack, water, etc.).[3] Movement becomes more efficient and the risk of injury declines. This is especially important for an activity that occurs in extreme and remote environments. Resistance training, in addition to the strength gained, also increases the muscle's levels of ATP, creatine phosphate, free creatine, glycogen, and an increase in the quantity of enzymes that control the anaerobic breakdown of glucose.[8] This is just a short list of those factors that may affect alpine activities in extreme environments.

Resistance Training Program Variables

Balancing off a periodized aerobic conditioning routine with a resistance training program designed to increase strength is going to demand discipline and motivation from the individual. For the sake of time and

Table 2. Resistance Training Program Variables for Strength

	Initial phase:	Progressing to:
Sets	3	3–5
Repetitions	5–8	5–8
Intensity	80% 1RM	80% 1RM
Rest	2 minutes rest	2 minutes rest

References 1, 3, 5.

safety a program based on compound exercises is recommended. A combination of squats, dead-lifts, power cleans and hang cleans at 80% of a 1-rep maximum (1RM) for 5-8 repetitions are recommended.[3, 5] Three sets of each exercise are recommended early in the training program with room to increase to five sets.[3, 5] A 2 min rest period between sets will aid in recovery and help to develop the strength needed to perform well in alpine activities. A 12 to 16 week periodized prescription over the course of 3 to 5 days a week would minimize the risks for overtraining and injury and help the individual peak at the designated time.[3, 5] See Table 2 for a summary of the resistance training variables.

Isolation resistance exercises may be performed after the compound exercises. Isolation exercises help strengthen the muscles that surround important joints such as the knees and shoulders. Isolation exercises also add an aesthetic quality to the athlete's frame which may translate into self-confidence, adding a psychological component for success. Isolation exercises should be performed at 8-10 reps for three sets per body part. A 70% to 75%1RM, 3 days a week would reduce the chances of overtraining.[3, 5] All resistance training exercises should be performed prior to aerobic training to reduce the incompatibility of aerobic training with resistance training.[3, 5] The combination of a periodized exercise prescription and adequate rest between workouts may decrease this effect.[3, 5]

Summary

Training for alpine related activities is always an excellent idea, but it is in no way a guarantee of success or safety. While resistance training and aerobic training may help offset the compromising effects experienced at high altitude, the symptoms associated with oxidative stress are extremely individualized. As alpine related activities continue to gain popularity, we can expect an increase in research related to performance, oxidative stress, high altitude cerebral edema, and high altitude pulmonary edema.

Attaining one's goal in extreme environments is an option. Returning safely is not. Smart training, excellent preparation, and good judgment will help to promote a safe and transcendent experience.

About the Author

Thomas P. Mahady is the senior exercise physiologist in the Cardiac Prevention and Rehabilitation Center at Hackensack University Medical Center. In addition to his eighteen years as a clinical exercise physiologist, Tom also is an avid hiker and mountaineer and has trained former patients for outdoor activities.

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SELF-TEST ANSWER KEY FOR PAGE 15

	Question 1	2	3	4	5
TEST #1:	C	B	A	B	A
TEST #2:	B	C	D	B	C
TEST #3:	D	C	D	A	B
TEST #4:	A	B	C	C	C

APRIL – JUNE 2010 Continuing Education Self-Tests

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SELF-TEST #1 (1 CEC): The following questions were taken from "Resistance Training Intensity: Research and Rationale " published in this issue on page 3.

1) Intensity in RT activities is most often characterized by which method?
a. % HRmax b. % HRR
c. % 1RM d. % lactate threshold

2) If exercise intensity is set at 80% of 1RM, a trained individual should complete 8-12 repetitions for all exercises.
a. True b. False

3) Which of the following would you expect to complete a higher number of repetitions for any given 1RM intensity?
a. Trained individual
b. Untrained individual
c. There should be no difference between trained and untrained individuals
d. None of the above

4) A set which utilizes an intensity of 90% 1 RM would be best characterized by which of the following statements?
a. High intensity, high volume
b. High intensity low volume
c. Low intensity, high volume
d. Low intensity, low volume

5) There is a strong body of evidence that supports exercise prescription for novice and intermediate lifters, who wish to improve muscular strength and/or hypertrophy, contain which load scheme for each exercise?
a. 1-3 sets of 8-12 repetitions
b. 3-6 sets of 8-12 repetitions
c. 1-12 sets of 6-12 repetitions
d. 1-3 sets of 15-25 repetitions

SELF-TEST #2 (1 CEC): The following questions were taken from "Piriformis Syndrome: A Real Pain in the Butt" published in this issue on page 5.

1. Piriformis Syndrome appears to occur in men more than women
a. True b. False

2. Which of the following movements is the piriformis muscle responsible?
a. Adduction of the thigh
b. Knee flexion
c. External rotation of the thigh
d. Internal rotation of the thigh

3. Which of the following activities is a probable cause of piriformis syndrome?
a. Swimming laps b. Jumping rope
c. Rowing d. Sitting

4. Which of the following is NOT a symptom of piriformis syndrome?
a. Spasming or tightness of the piriformis muscle
b. Numbness in the toes
c. Tingling in the low back and hamstrings
d. Toothache-like pain in the buttocks

5. What is the percentage of the U.S. population that suffers annually from low back associated pain?
a. 25%-30% b. 10%-15%
c. 15%-20% d. 20%-25%

SELF-TEST #3 (1 CEC): The following questions were taken from "Exercise as Adjuvant Therapy for Cancer" published in this issue on page 7.

1. Which of the following is a common condition associated with cancer?
a. Increased functional capacity
b. Increased muscle tissue
c. Improved immunity
d. Obesity

2. Which of the following is NOT a common response to exercise training in cancer patients?
a. Less reported fatigue
b. Better weight control
c. Decreased muscle mass
d. Improved cardiorespiratory endurance

3. There are an estimated ___ million people who have undergone/are undergoing cancer treatment.
a. 5 b. 7
c. 9 d. 11

4. Much of the research on exercise training performed during cancer treatment has been in patients with ____ cancer.
a. breast b. colon
c. lung d. liver

5. It has been reported that there is a ____ lower risk of death following a colon cancer diagnosis in those who were moderately active.
a. 50% b. 60%
c. 65% d. 75%

SELF-TEST #4 (1 CEC): The following questions were taken from "Training for Alpine Activities at High Altitude" published in this issue on page 12.

1. Altitude related decrements in performance may begin at _____ above sea level and continue to decline exponentially.
a. 1,900 feet b. 5,000 feet
c. 10,000 feet d. 29,000 feet

2. Acute physiological changes that affect physical performance begin at elevations above _____.
a. 1,900 feet b. 5,000 feet
c. 10,000 feet d. 29,000 feet

3. Oxidative stress is a term that refers to the production of _____.
a. lactate b. phlegm
c. free radicals d. fluid in the lungs

4. While Fartlek training is touted as a viable method of preparing for alpine related activities, this mode of training _____.
a. is too difficult for the average person
b. is specialized for the climbing community
c. is not systemic and measurable
d. is applicable to alpine environments only

5. Resistance training programs that employ compound exercises as part of the prescription provide an advantage for alpine styled activities because _____.
a. they require minimal equipment and space
b. they elicit a favorable hormonal response
c. they are specific to the activity and time efficient
d. they require very little instruction or prior training

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