ACSM’s CCRB
Working for You
Page 2

What is White and Brown and Beige All Over?
Page 3

Starting A Home-Based Personal Training Business
Page 4

Minimizing Legal Liability for the Exercise Professional: Strategies That Work!
Page 6

Coaching News
Page 8

Effects of Resistance Exercise on Bone Mineral Density
Page 9

Insulin Resistance, Cardio-Metabolic Risk, and Resistance Training
Page 10

Shoulder Pain Attributed to Weight-Training: Preventative Measures
Page 12
The Committee on Certification and Registry Boards (CCRB) spent 2013 maintaining ACSM certifications as the gold standard in clinical practice and in the health fitness industry. The CCRB is comprised of volunteers from both academia and industry who serve a three-year appointment on one of ten sub-committees representing each of the major certifications, international certification, publications, ethics, continuing education, and exam development. An executive committee oversees the sub-committees, discussing and debating important issues affecting certification. The CCRB meets face-to-face twice per year and the executive committee meets monthly via teleconference. CCRB sub-committees also meet via teleconference several times per year. The following are the highlights of CCRB accomplishments for 2013.

The number of ACSM certified professionals continues to increase, and more individuals were certified in 2013 compared to any previous year. There are currently 29,760 ACSM certified exercise professionals, with the Personal Trainer, the Health Fitness Specialist, and the Clinical Exercise Specialist certifications representing the largest number of certified individuals. This represents a 50% increase in ACSM certified individuals in the past three years.

ACSM, in collaboration with the Association for Ringside Physicians (ARP), developed the ACSM/ARP Certified Ringside Physician certification. This new specialty certification is designed for physicians who are involved in the care of boxers, mixed martial artists, and other competitors in the combat arts, with the goal of improving medical care of these athletes.

The Exercise is Medicine® credential is now available. It contains three levels that are designed to serve clients and patients depending upon their health status. The eligibility requirements for the three credential levels vary, based on the level of current ACSM certification and educational level. More information can be accessed at certification.acsm.org/exercise-is-medicine-credential.

The CCRB is responsible for the publication of ACSM’s certification-related text books. New editions of four books were published in 2013, including ACSM’s Guidelines for Exercise Testing and Prescription, ninth edition and ACSM’s Resource Manual for Guidelines for Exercise Testing and Prescription, seventh edition. This year, the CCRB published two new books, ACSM’s Resources for the Health Fitness Specialist, with Gary Liguori, Ph.D., FACSM, serving as senior editor and ACSM’s Behavioral Aspects of Physical Activity and Exercise, edited by Claudio Nigg, Ph.D. Both books are excellent resources for those who are currently certified as well as individuals preparing to take a certification exam.

Because new editions of ACSM’s Guidelines for Exercise Testing and Prescription and other texts were published, all workshop and exam materials were updated to reflect the new content. An effort to further improve customer service, exam development, and certification maintenance was made by investing in new software to streamline many activities associated with certification.

We have reorganized our international certification efforts by adding two members to our international certification committee. Each committee member is responsible for a global region. This allows us to manage the increased activity in a more coordinated manner. Given our international growth and interest from a variety of international contact, the CCBR is in the process of developing international versions of the ACSM Certified
WHAT IS WHITE AND BROWN AND BEIGE ALL OVER?

By Gregory B. Dwyer, Ph.D., FACSM

Adipocytes exist in at least three types; white, brown, and beige. You may have learned that brown fat, also known as Brown Adipose Tissue (BAT), is not as important to adults as white (yellow) adipose tissue as it was thought not to be present in adults. This BAT was thought both prevalent and important to both rodents (mice) and human infants; for instance, up to 5% of an infant’s body weight may be BAT. Research starting in 2007 found the presence of this BAT in adults somewhat by accident in positron emission tomography (PET) cancer scanning. BAT contains more iron-rich mitochondria giving them a “brown” appearance. BAT also may contain more oxygen supplying capillaries and the signaling protein (UCP1) that “uncouples” energy metabolism toward a more “wasteful” thermogenesis (heat production) state than in white fat cells. While white fat cells are the primary storage site for lipid droplets in our energy reserves, BAT is associated with increased thermogenesis and thus energy expenditure (as opposed to storage in white fat cells). This BAT has been found to exist in the upper body and neck areas in adults.

What is this “beige” in fat cells? While BAT is quite distinctive in cell origin, beige fat cells may not be. Beige fat cells are “similar” in the many “metabolic” characteristics studied in the laboratory as BAT however the “lineage” of beige fat cells can be traced from white fat cells. While the clinical relevance of this research is still to be determined, it appears that beige fat cells may be stimulated into existence by cold temperature exposure and some pharmaceutical agents like ephedra. However, weight loss implications are not so clear at this time in this evolving area of research. There is a potential to stimulate a transformation in fat cell type (from white to beige) to increase energy expenditure and weight loss with various metabolic benefits.

It has been found that the presence of BAT and beige fat cells reduces metabolic disease, including obesity and type 2 diabetes in mice. It is of interest that an inverse relationship also was found in a study of human subjects between the content of BAT and the Body Mass Index. Thus, obese individuals and patients with type 2 diabetes have a lower percentage of BAT than other individuals.

As is the nature of evolving science, more details await to be flushed out on the relevance of BAT and beige fat cells. The science of discovery about both BAT and beige fat cells is quite new, cellular, and genetic. More epidemiological research in humans is needed in this area to better understand the prevalence and importance of BAT and beige fat cells. I would certainly encourage all exercise professionals to stay tuned and follow these developments with a critical eye.

About the Author
Gregory B. Dwyer, Ph.D., FACSM, is a clinical exercise physiologist and professor in the Department of Exercise Science at East Stroudsburg University of Pennsylvania (ESU). He is certified as an ACSM Exercise Test Technologist, ACSM Exercise Specialist, ACSM Program Director, and ACSM Registered Clinical Exercise Physiologist. Dr. Dwyer has written two main textbooks (ACSM Health-Related Physical Fitness Assessment Manual and ACSM’s Metabolic Calculations Handbook) as well as numerous chapters for textbooks and a learning CD-ROM. Dr. Dwyer is the senior editor for the ACSM’s Certification Review Manual.

References
Starting a Home-Based Personal Training Business

By Justin Recklau, MS, HFS

There are many reasons to start an in-home personal training business. Some people want to do things in a unique way. Others may need the flexibility of having their own business. Some may simply need extra income in addition to their normal employment. Still, some just want a new challenge. Whatever your reasons, hopefully this article will help put things into perspective and get you on your way.

In-home personal training offers many advantages. One of the major benefits is the low initial capital outlay. There are no storefront rent costs, no paying a gym to use their facility nor having to pay a gym a percentage of revenues. You can start a successful business with a car, some bands or other portable fitness equipment, a normal home office setup with a printer, and a smartphone. It would also be wise to refer to books or web sites on starting a fitness business, such as, Starting a Fitness Business.

Another benefit is that clients who want you to come to them are usually more affluent, paying for the convenience and discretion that onsite fitness offers.

There also are some disadvantages to consider before taking the plunge. Scheduling and transportation costs (gas, vehicle maintenance, mileage, tolls, parking, etc.) are a big factor. Additionally, you will have all of the headaches of any small business, including taxes, deductions, and liability insurance. To help with taxes, deductions, and identifying profitability, you should keep accurate records of all transactions and establish a business checking account to track both income and expenses.

All personal trainers should have liability insurance and ACSM certified trainers can purchase insurance through many sources, including Forrest T. Jones & Company. It is also important to maintain a current knowledge base and be familiar with all industry standards and guidelines in order to maintain personal trainer certification status and to minimize liabilities by following best practices. The risk of injury can be reduced by instituting procedures like pre-activity screenings and by using an individualized approach to client’s exercise programs, as per the guidelines set out in the second chapter of the ninth edition of ACSM’s Guidelines for Exercise Testing and Prescription. The risk of injury for a properly designed fitness program is exceptionally low, but many fitness fads are not founded on good science or best practices. Therefore, to make sure that you avoid a long, expensive lawsuit, don’t get drawn into incorporating activities into your exercise programming just because they are popular.

To get certified, trainers have to learn proper speed of exercise, biomechanics, resting periods, what to do in the event of an emergency, and other concerns. Give yourself a constant refresher and have policies in place. For more resources and information regarding various ACSM certifications, visit certification.acsm.org/get-certified. Lastly, personal safety is always important, so use your best judgment, initially meeting in a public place, having your cell phone on you, and paying attention to your surroundings.

Being efficient and effective is of paramount importance to profitability. Get organized, determine session times, always confirm appointments before going, and have a cancellation policy and fee in place. An excellent book on time and people management is, The 7 Habits of Highly Effective People.

Commute times also are unpaid, so try to group clients by location, when possible. The lack of a storefront, although less expensive, makes walk-ins impossible, although branding your shirt and car are excellent advertisement strategies. You also may find yourself with downtime in odd locations, so it is wise to get an internet-enabled tablet, bring a book, read CEC articles, run errands, etc.

Now comes one of the bigger challenges: sales! One fundamental book on interpersonal relations, which strongly translates to sales, is How to Win Friends and Influence People. Getting clients is the lifeblood of your business. Low-cost advertising includes Craigslist, eBay classifieds, and local bulletin boards. Google is another great advertising tool that is based upon a cost-per-click. Consider buying branded t-shirts, creating business cards, and creating a large magnet decal for your car. More recently, building a web site has become free, easy, and not particularly time consuming, using tools such as Google Sites or Webs.
effective advertisement, however, is your clients. Treat them well, give them excellent service, and offer incentives, such as free ses-
sions, for referrals.

The proper equipment is very important. Resistance bands are
effective, portable, and durable. Exercise balls, yoga mats, calis-
thenics, and small dumbbells also can be effective. Many clients
have the equipment, so make sure that it is properly maintained
and familiarize yourself with it before putting them on it. To limit
liability issues, equipment should be used only for the functions
that the manufacturer has specified for it. You want to always
have spares of everything and, if you plan to sell equipment, keep
sufficient inventory.

It is important to know your market to determine what your
market pays and what you should charge. The Bureau of Labor
Statistics gives local wage charts, which are freely available at its
web site. You also can search Craigslist, the classifieds, as well
as looking at what local gyms are charging per session. You can
typically charge a bit more than most gyms due to the conve-
nience factor. Another pricing differentiator is if you have top
tier certifications which are approved by an external accredita-
tion is a mark of distinction in all professions. To find
other certifications that have received external accreditation, visit
the National Commission on Certifying Agencies certification
search tool at www.credentialingexcellence.org/p/cm/id/ld=121.

Developing a potential niche is analogous to specialization in
medicine, with similar increases in potential income. It would
be wise to view specialty certifications that may be of interest to
you and of value to your target market at certification.acsm.org/
specialty-certifications. Currently, a niche in high demand stems
from the Exercise is Medicine initiative, which enables trainers
to work with clients with controlled chronic diseases, disabilities,
and conditions. There are three levels of certification for this and
a personal trainer’s formal education, industry certification level,
and type determine the certification examination tier level (I, II,
or III) that they take. In addition, ACSM offers a number of
specialty certifications for people who want to create a niche.

Some markets are simply not affluent enough to support starting
a one-on-one fitness business. Group fitness or exercise classes
may work in such markets, though. Due to the wide variety of
Continuing Education Credit (CEC) courses and the impor-
tance of staying current as a best practice in a dynamic field, it
is wise to plan a career roadmap to ensure that you are spending
time and money effectively, in agreement with your long term
professional goals. To find available ACSM CEC options, visit
certification.acsm.org/continuing-education.

As you develop your business, you may be faced with an excellent
problem to have: the need to prune clients. When starting up,
unless you have other income, you have to take what you can get,
as long as it is safe for you and for them. After you are up and
running, you may have the luxury of becoming a little more selec-
tive to maximize profitability. If possible, hire on a subcontractor
and hand-off some clients to them (charge the subcontractor a
finder’s fee or a percentage of revenues for doing this) or, if ne-
cessary, discontinue seeing the client or cut down the frequency.
Target problem clients, who may cancel often, are very difficult to
work with, or live in a remote location with no other clients near-
by. Also, it is wise to discontinue seeing the less profitable clients,
which may be geographically undesirable, unwilling to allow for
rate increases, etc. You can develop a spreadsheet that factors in
time and mileage to determine what to charge. You want to keep
the above average profitability clients and cut the below average
profitability clients. We want to help as many people as we can,
but we also have to take care of our own sanity and bottom line.

Suggested Resources: Although this list certainly is not ex-
haustive, the following are some items that may make it easier to
succeed with your fitness business.

- **ACSM’s Health/Fitness Facility Standards and Guidelines:**
  This resource is a very good tool for health and fitness pro-
fessionals to have and can be viewed at: www.humankinetics.
  com/products/all-products/ACSMs-HealthFitness-Facility-

- **Injury Prevention:** Search the ACSM web site for informa-
tion related to injury prevention by visiting: www.acsm.org/
  access-public-information/search-by-topic/search-by-top-
  ic/?RelatedTaxonId=4e4fa280-a507-4cd5-935a-dd161a70af2.

- **Quality Information:** The ACSM Get Public Information
  Link contains the ACSM Position Stands, brochures, and a
  number of other resources for personal trainers and their clients
  and can be viewed at: www.acsm.org/access-public-information/
  search-by-topic/search-by-topic/?RelatedTaxonId=4e4fa280-
  a507-4cd5-935a-dd161a70af2.

**About the Author**

Justin Recklau, MS, HFS, is currently a personal trainer
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background includes vascular and renal physiology
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He is a successful fitness entrepreneur who enjoys
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MINIMIZING LEGAL LIABILITY FOR THE EXERCISE PROFESSIONAL: STRATEGIES THAT WORK!

By JoAnn M. Eickhoff-Shemek, Ph.D., FACSM, FAWHP

Introduction

In today’s litigious society it is essential that exercise professionals have a working knowledge of legal and risk management concepts. All types of injuries — minor, major, and life threatening — can occur in exercise programs. Often, these injuries are due to either inherent risks (they are no one’s fault, they just happen) or negligence (carelessness) of the exercise professional or fitness facility. Injuries due to negligence, and the costly litigation that often follows, can be prevented through the development and implementation of risk management strategies. This article will describe: (a) legal liability exposures, which are situations that can create a risk for an injury that can lead to negligence claims and/or lawsuits (see Figure 1), and (b) risk management strategies that minimize legal liability exposures and thus decrease the number of injuries and subsequent litigation.

Legal Liability Exposures and Negligence

Legal liability exposures often occur when exercise professionals do not carry out their legal duties by either failing to do something (inaction) or doing something but in an inappropriate manner (improper action). These failures can result in negligence claims made by plaintiffs (injured parties) against defendants (exercise professionals and fitness facilities) such as:

1) Failed to provide an exercise professional (e.g., personal fitness trainer or group exercise leader) with sufficient knowledge, training, and experience to safely instruct the plaintiff
2) Failed to instruct and/or supervise (or improperly instructed and/or supervised) the plaintiff
3) Failed to have a written emergency action plan and/or properly carry out emergency action procedures

Legal liability exposures exist in seven major areas as shown in Figure 2. These three negligent claims reflect liability exposures in: 1) Employment Issues, 4) Instruction and Supervision, and 7) Emergency Action Plan, respectively. It is beyond the scope of this article to describe the major legal liability exposures in each of these areas and the corresponding risk management strategies to minimize them. However, this information is available elsewhere.

In a negligence lawsuit, the plaintiff has to prove that the defendants had a duty, breached that duty, and that the breach of duty caused the injury. Although courts determine duty, they allow expert witnesses to educate the court regarding the specific duties the defendants owed to the plaintiff and whether or not the defendants breached any of their duties. In their testimony, expert witnesses often rely on safety standards, guidelines, and/or position papers published by professional organizations such as the American College of Sports Medicine (ACSM) to help provide evidence of the duties defendants owe to plaintiffs. For example, in Mimms v. Ruthless Training Concepts, LLC, the expert witness referred to an ACSM position stand as evidence that the exercise program directed by the fitness trainer did not follow the safety recommendations set forth in this position stand. Therefore, one of the first steps in developing risk management strategies is for exercise professionals to become aware of such publications and to determine whether or not they are adhering to the requirements and/or recommendations described within them.

Risk Management Strategies

Head and Horn describe several risk management strategies that include:

- exposure avoidance
- loss prevention
- loss reduction
- contractual transfer

Exposure avoidance strategies eliminate entirely the risk of injuries. For example, some fitness facilities may opt to not: (a) offer high intensity exercise programs, (b) provide free weights, and (c) install treadmills. High intensity exercise programs, also known as extreme conditioning programs (ECPs), have been associated with an increased risk of injury. Regarding weight-training related injuries, a high number of injuries (90.4%) have occurred with free weights. This same study showed that individuals using free weights sustained a significantly higher proportion of serious injuries (e.g., fractures/dislocations) than individuals using machines. Injuries due to falls on treadmills are common and have resulted in negligence lawsuits. The increased risk of injuries associated with these types of activities can be minimized,
but exercise professionals need to take a well-informed, concerted effort to do so.

Loss prevention strategies help prevent injuries from occurring in the first place and loss reduction strategies help mitigate (reduce the severity and any negative consequences) an injury once it occurs. The following negligence claims (also listed in the “Legal Liability Exposures and Negligence” section) list examples of loss prevention strategies (under claims 1 and 2) and loss reduction strategies (under claim 3) that exercise professionals can develop and implement to minimize legal liability exposures.

Claim 1 — Failed to provide an exercise professional (e.g., personal fitness trainer or group exercise leader) with sufficient knowledge, training, and experience to safely instruct the plaintiff
  • Hire only qualified and competent employees
    ◦ Qualified means possessing certain credentials (e.g., degree, certification, etc.)
    ◦ Competent means knowing “how” to design and teach safe and effective exercise programs (i.e., applying safe principles of exercise such as progression)
  • Provide adequate training (initial and continuing) for employees
  • Establish written “scope of practice” guidelines for exercise professionals who design/lead exercise programs and provide nutrition and/or nutritional supplement information (e.g., only those exercise professionals with advanced credentials in clinical exercise should train individuals with certain medical conditions and only “general” information regarding nutrition/nutritional supplements should be provided versus “individualized” advice)
  • Formally observe and evaluate the job performance of employees

Claim 2 — Failed to instruct and/or supervise (or improperly instructed and/or supervised) the plaintiff
  • Offer a fitness facility orientation for new participants that includes:
    ◦ Instruction on the proper use of the exercise equipment and facility as well as how to obtain this instruction at anytime
    ◦ Instruction on the facility’s safety policies and procedures and the participant’s responsibility to follow these
    ◦ Instruction of basic principles of safe and effective exercise
    ◦ Instruction to make participants aware of warning labels on exercise equipment and safety signage throughout the facility
  • Provide proper staff supervision of the facility at all times

Claim 3 — Failed to have a written emergency action plan and/or properly carry out emergency action procedures
  • Prepare a written emergency action plan (EAP) that contains contingency plans for various medical (and other) emergencies
  • Ensure employees have current CPR/AED and first-aid certifications at all times
  • Provide regular in-service trainings for employees that cover the written EAP including drills/rehearsals with regard to each contingency plan
  • Provide and maintain a first-aid kit and AED
  • Properly complete an incident report form after every emergency

Risk management strategies that involve a contractual transfer include waivers and liability insurance. These strategies are effective only after an injury has occurred and a negligent claim or lawsuit has been made against the defendants. Waivers — contracts signed by individuals prior to participation — contain exculpatory language that absolves (protects) the defendants from their own negligence. Waiver law is quite complex and is based on individual state laws. For example, how explicit the exculpatory language needs to be varies from state to state and in some states such as Virginia, waivers are not allowed because they are against public policy. Exercise professionals need to consult with a competent lawyer in their jurisdiction before considering using a waiver.

If the defendants are found liable for negligence, their liability insurance provider is contractually obligated to pay out the damages — the amount of money awarded to the plaintiff by the court — up to the limits specified in the policy. To protect their personal assets, exercise professionals need to purchase their own “professional” liability insurance, whether they are employees or independent contractors. Often, employers have purchased a “general” liability insurance policy but they do not provide professional liability insurance coverage for their employees. ACSM members can purchase a professional liability insurance policy through Forrest T. Jones and Company, Inc. (www.ftj.com/ACSM).

Conclusion
Exercise professionals have an overall legal duty to provide reasonably safe programs and services to their participants — meaning they need to develop and implement both loss prevention strategies that help prevent injuries from occurring and

Legal Liability (continued on page 14)
Today we explore how to work with a client who is an avid runner and competes in many road races and marathons on the weekends. She has sustained a stress fracture and cannot run for 8 to 12 weeks. She is very concerned about maintaining her fitness, being ready for an upcoming marathon, and managing her weight and her stress levels. She has not done any other type of training in a long time and seems very reluctant or fearful of doing anything else.

Anyone who depends upon regular exercise to stay sane in today’s crazy world could be terrified about losing the incredible benefits of exercise when stopped in their tracks due to an injury or surgery that requires a long recovery period. What are some tools and techniques that allow our clients and ourselves to recover well and return stronger than ever?

Be a curious explorer: A great antidote to feeling frustrated and disappointed during a long recovery is to cultivate a curious and open mind that is looking for new adventures. Questions to consider: How can I look at my situation in new ways? What can I do differently? What do my mind and body need right now? How can I recover quickly and well? What is there to learn? This is a time for new questions, and a time when there are more questions than answers.

Soften the need to be in control: The sense of freedom and being in control is heightened by mastery of an intensive exercise routine. It’s incredibly hard to watch others running when you are grounded for a long while. Perhaps the recovery experience is a way to learn to better accept what we can’t control, reminding ourselves of the serenity prayer, which I phrase as: accept the things I cannot change, be courageous about the things I can change, and get wise about knowing the difference.

Make the experience meaningful: A valuable tool to rising to the challenge is to have faith that there will be silver linings, although not immediately apparent. Humans learn and grow stronger through setbacks. Whatever led to an injury such as a stress fracture is the body’s way of telling us that something isn’t quite right. While the full value of a setback may not appear until long after recovery, an open and curious mind that is looking for new meanings will be a great asset along the way. For example, a good physical rest may lead to healing of all sorts of physical stresses and strains from head to toe that a nonstop exercise routine prevents. Or it will be just the catalyst needed to experiment with changes in a stable exercise routine. Even better, the time freed can be used to create and enjoy new experiences.

Learn new approaches to regulating emotions: If you use running or exercising to tame emotional frenzy, stress levels may get more challenging during recovery. The time saved during recovery can be invested in developing new mental skills for handling negative emotions. Mindfulness techniques allow us to unhook from a burst of negative thoughts that come with a post-injury phase (Yikes! My cardio fitness is dropping like a stone. My muscles are going soft. My marathon time will be shot. I will gain weight…). This is also a good time to invest the time saved in not running to harness and harvest positive emotions: What professional and personal tasks make you feel good and how can you do more of them? What blessings can you count?

Seek compassion and love: The biological method for soothing the scared emotions of a newborn is the tender soothing by the parents, which releases a neurochemical called oxytocin (also known as the hormone of love). This same soothing phenomenon works just as well in adults, except we can soothe ourselves with big-hearted self-kindness. A recovery period is an excellent time to exercise your self-compassion. And, connect with other people who have done well in recovering from long injuries and benefit from their empathy and compassion during this tough phase.

Enhance body intelligence: It’s time to improve the depth of listening to what your body needs each moment and over the next days and weeks. What adjustments to eating habits are needed to handle lower calorie needs? What exercises feel good and safe right now? Perhaps this is an opportunity to slow down your eating pace, savoring fully by chewing every bite at least 30 times. Or maybe there is an opportunity to trim some empty-ish calories to keep weight stable.

Get creative: One of the best interventions for mental and physical suffering is to engage in creative tasks. You could experiment with cooking new recipes, write poems or blogs, play the piano, or submit funny lines to The New Yorker for its weekly cartoons.

Recalibrate self-esteem: If your self-worth is closely connected to the state if your physique and fitness level, maybe this is a time to have your inner judge go on vacation, detaching your self-respect from your physical fitness. You could then set a good standard for simply dealing well with the physical setback, focusing on healing, increasing equanimity, and learning new life lessons.

Build confidence: One of the main variables that predicts life satisfaction is resilience, the ability to bounce back from adversity. Take stock of all your personal strengths that have made you resilient in the past and look for creative ways to use you strengths in new ways during the recovery phase. This is a great opportunity to build resilience muscles.

Reset goals: An injury is an opportunity to hit the reset button and to rethink fitness and life goals, at least in the short term. A great goal is to simply aim to recover beautifully, to not rush the biological processes, and to allow the body’s talents for healing to run well, so that you can run well when this phase is behind you.

Coaching News (continued on page 14)
Effects of Resistance Exercise on Bone Mineral Density

By Wayne L. Westcott, Ph.D.

We live in an extremely sedentary society, with fewer than 3.5% of adults engaged in 30 minutes of moderate intensity physical activity, five days a week as recommended by the American College of Sports Medicine (ACSM). Specifically, men and women who do not perform regular resistance exercise experience ongoing loss of muscle (sarcopenia) and bone (osteopenia). Osteopenia (beginning bone loss) typically progresses to osteoporosis (advanced bone loss), which leads to bone fractures in more than 30% of women and 15% of men. According to the National Osteoporosis Foundation, approximately 10 million American adults (including 8 million women) have osteoporosis, and almost 35 million others have osteopenia.

In people over age 50, muscle loss can approach 10% per decade, and bone loss can reach 30% per decade. Muscle mass is associated with bone mineral density (BMD), such that decreases in muscle mass are generally accompanied by decreases in BMD and increases in muscle mass are generally accompanied by increases in BMD. A large number of longitudinal research studies have demonstrated significant increases in bone mineral density following 4 to 24 months of resistance training. A 1999 meta-analysis of the bone density research by Wolfe and associates indicated that exercise interventions either prevented or reversed approximately 1% per year of the bone loss in both pre- and post-menopausal women (lumbar spine and femoral neck sites). Ten years later, an updated research review by Going and Laudermilk revealed that strength training increased bone mineral density between 1% to 3% in both pre- and post-menopausal women (lumbar spine and femoral neck sites).

On the other hand, some studies have not shown significant increases in bone mineral density as a result of resistance exercise. Cussler and colleagues have suggested that the inconsistent research findings may be due to several factors, including small numbers of study subjects, relatively short training periods, low rates of program completion, lack of randomization to the study protocols, and different levels of training intensity.

Nutrition variables also may influence the impact of exercise on bone mineral density. Although a meta-analysis of exercise effects on BMD by Kelley and colleagues did not show significant differences for calcium and vitamin D intakes, other studies have demonstrated a positive association between protein, calcium, and vitamin D consumption and desirable changes in bone mineral density.

A 2011 study with adults and older adults compared the effects of resistance exercise with and without nutritional supplementation on muscle mass and BMD. The strength training protocol consisted of 12 standard resistance machine exercises, performed for 1 set of 8 to 12 repetitions, using full movement range and controlled movement speed, with progressive weight load increases (about 5%) whenever 12 repetitions were completed in correct form. The nutritional components included 500 mg of calcium daily, 1200 IU of vitamin D daily, and 24 grams of protein coupled with 36 grams of carbohydrate (shake) immediately following each exercise session. Following a nine-month training period, the exercise plus nutrition group added significantly more lean weight than the exercise only group and the control group (+5.2 lbs.; +3.9 lbs.; -2.1 lbs., respectively). Similarly, the exercise plus nutrition group experienced a 1.0% increase in BMD, the exercise only group maintained BMD, and the control group experienced a 1.0% decrease in BMD. Although the bone mineral density differences did not reach statistical significance, these results seemed to support several studies that have demonstrated a positive relationship between muscle mass/strength and BMD. These findings also appeared to affirm research that revealed a positive association between consumption of certain nutrients (calcium, vitamin D, protein) and bone health.

Much of the research on resistance training and bone mineral density has been conducted with middle-aged and older adults, with particular attention to women. However, there is evidence that young men also may increase bone mineral density between 2.7% to 7.7% through a progressive program of strength training. The relatively wide range of bone mineral density changes is apparently due to different responses in different bones, as the musculoskeletal effects of resistance exercise seem to be site specific.

Practical Application

Based on the studies reviewed and referenced, it is proposed that a combination of resistance exercise and supplemental nutrition represents a relatively comprehensive and productive means for enhancing musculoskeletal fitness in general and for increasing bone mineral density specifically. It is suggested that resistance exercise programs should be progressive and consistent with the ACSM strength training guidelines (ACSM 2010), and that the supplemental nutrition includes calcium, vitamin D, and post-exercise protein.

About the Author

Wayne L. Westcott, Ph.D., teaches exercise science at Quincy College in Quincy, MA, and has served on the executive committee of the New England Chapter of the American College of Sports Medicine.

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References for this article can be found at certification.acsm.org/cn-q4-2013
INSULIN RESISTANCE, CARDIO-METABOLIC RISK, AND RESISTANCE TRAINING

By William Boyer, BSH

Overview

There is an increasing need to understand and better manage diabetes in the United States (U.S.) population. Moreover, complications from diabetes lead to reduced quality of life, resulting from lack of knowledge about the disease, and poor management of related comorbidities. It is imperative that the clinical and health professional understand the basics of diabetes and its relationship with exercise in order to improve the health status of those with this disease. Furthermore, understanding the preliminary issues that can cause diabetes gives the health care specialist the ability to reduce the likelihood of development in the at-risk population. This article will: 1) provide a description of diabetes, defining and physiologically understanding type 2 diabetes and insulin resistance (IR), prevalence estimates and economic impact; 2) describe the relationship between diabetes and other diseases and metabolic complications; 3) describe the relationship between resistance training (RT) and IR in people with and without diabetes; and 4) briefly summarize the important topics addressed in this article.

Definition, Types, and Economic Impact

Diabetes is defined as a group of diseases characterized by high blood glucose levels resulting from defects in the ability to produce and use insulin properly. Approximately 5% to 10% of all cases of diabetes are either type 1, gestational, or environmental. Type 1 diabetes usually begins in early childhood and is attributed to the complete destruction and inability of the β-cells to produce insulin. Gestational diabetes is a condition that sometimes occurs in women during pregnancy. Environmental diabetes stems from a number of complications including: pancreatic diseases, pancreatic injury, steroid use, genetic defects of β-cell function, medications, or genetic complications.

Type 2 diabetes, characterized by IR, makes up approximately 90% to 95% of all cases of diabetes. This is the most prevalent type of diabetes and it is important to understand its basic pathophysiology, particularly because of its strong relationship with obesity and physical inactivity. Insulin resistance is defined as the inability of the body to properly utilize endogenous insulin in an effective manner to regulate glucose control. After ingestion of a meal, blood glucose levels rise following absorption. In response to this, pancreatic β-cells secrete insulin in order to regulate the uptake of glucose from the blood into insulin sensitive tissues (skeletal muscle, liver, adipose) by binding to specific receptors in these tissues. Insulin then signals to what is known as an insulin-regulated glucose transporter (GLUT4), which facilitates the uptake of glucose in to the tissues. In a person who is IR there is a problem either at the insulin binding site, within the signaling pathway, or with the glucose transporter.

Type 2 diabetes is increasingly becoming a problem affecting the health and wellness of the U.S. population. The current prevalence of diabetes in U.S. adults is approximately 8.3%. This includes both diagnosed and undiagnosed individuals. It is projected to reach 21% to 33% based on recent trends in diabetes incidence. The economic impact of diabetes in the U.S. in 2012 totaled 245 billion dollars. Based on these estimates, it can be said that diabetes will continue to be a serious health care concern in the future. Thus, it is imperative that the practicing exercise professional recognize the severity of this disease and how to reduce risk for future development.

Insulin Resistance & Cardiovascular Disease

IR has been shown to be associated with cardiovascular disease (CVD) and complications in people with and without diabetes. In a study conducted by Bonora et al., 1,326 patients with type 2 diabetes were examined to assess the relationship between IR and CVD. Analysis revealed that there was a significant relationship between IR and prevalence and incidence of CVD. This study also revealed that in people with diabetes, greater levels of IR are associated with increases in prevalence and incidence of CVD. This is important to understand because it illustrates the
severity of higher levels of IR even in those with diabetes. Hedblad et al, investigated the relationship between incidence and risk of coronary events and IR in people without diabetes. Results revealed that those defined as having IR were at a higher risk for both a coronary event as well as all-cause mortality. Results from this study show that IR, the precursor to type 2 diabetes, has significant impacts on future health risk in apparently healthy populations.

It is well established that metabolic disorders such as hypercholesterolemia, hypertriglyceridemia, hypertension, low-HDLs, and impaired glucose tolerance (IGT) are associated with an increased risk for CVD and other metabolic diseases. Another study conducted by Bonora et al, examined the prevalence of IR among these specific metabolic disorders in 888 subjects ages 40 to 79. Results indicated that the prevalence of IR was 53.5% in hypercholesterolemia subjects, 84.2% in hypertriglyceridemia subjects, 88.1% in subjects with low HDL cholesterol, and 58.0% in hypertension subjects. These results illustrate the impact and relationship IR has with several metabolic risk factors. This further the established need for adequate interventions that can reduce overall risk for complications due to IR.

**Insulin Resistance and Resistance Training in those with diabetes.**

The associations between RT and IR in subjects with diabetes is clearly defined. Brooks et al, investigated the effects a 16-week RT protocol had on insulin sensitivity and glycemic control in Hispanic adults (>55 years) with type 2 diabetes. Those participating in the RT protocol had significantly lowered IR levels following the intervention. Ibanez et al, revealed that a twice-a-week RT protocol lasting 16-weeks had favorable impacts on IR. Results from these studies indicate that RT can favorably impact IR in subjects with type 2 diabetes. Potential mechanisms explaining these results include reductions in insulin needed in response to a glucose load attributable to increases in insulin sensitive tissue (skeletal muscle), or increases in the activity of glucose transporters.

**Insulin Resistance and Resistance Training in those without diabetes**

There is a paucity of research investigating these associations in subjects without diabetes. There is a significant need to better understand this relationship in order to approach IR from a preventive viewpoint and potentially reduce the incidence of type 2 diabetes. Cheng et al, reported a significant decrease in IR in 4,504 subjects without diabetes. Ahmadianz et al, investigated the effects of resistance and endurance training on IR in 24 healthy males (age 35 to 48). Results revealed a significant decrease in IR in those participating in RT. Similar results were seen in subjects participating in endurance training. Results from these studies indicate that even in healthy subjects, RT has significant positive effects on IR. This could be attributable to increased amounts of insulin sensitive tissues (skeletal muscle), as well as decreases in insulin response to a glucose load. Another study conducted by Gjøvaag et al, investigated the effect of resistance training with different loadings on GLUT4 in subjects without diabetes. Significant changes were seen in GLUT4 content for all groups (64%, p<0.001). Furthermore, subjects participating in RT at moderate loads (60% 1-RM) had significantly increased GLUT4 content (128% vs. 13%, p<0.001) compared to subjects participating in RT at lower loads (30% 1-RM). Interestingly, GLUT4 content returned to baseline levels following 8 weeks of detraining. The results suggest that RT has significant impacts on GLUT4 content, specifically at moderate loads. However, RT must be continued if increased GLUT4 levels are to be maintained. It is important to note that all of these studies used different protocols in regards to RT. Furthermore, some of these studies also included aerobic training (AT). There are specific recommendations set forth by the American Diabetes Association and the American College of Sports Medicine for subjects with diabetes in regards to RT and AT (see suggested readings). However, it is important to take an individualized approach for each subject in order to maximize effects in a safe and effective manner.

**Conclusions**

The current evidence of the impact of IR and its subsequent associations with RT highlight several important facts: 1) diabetes incidence and prevalence is likely to continue increasing; 2) there is a strong association between IR and CVD and IR and metabolic dysfunction; 3) RT has been shown to have favorable impacts on IR in people with and without diabetes; and 4) it is imperative that exercise professionals continue to recommend and prescribe adequate volumes of RT to all patients and the general population in order to reduce risk of type 2 diabetes and increase quality of life.

**About the Author**

William “Bill” Boyer, BSH, (MSH 2014), is currently completing his second year in the Exercise Science and Chronic Disease graduate program at University of North Florida. He is a graduate research assistant as well as an adjunct instructor teaching Exercise Physiology Laboratory Methods. His primary research interests are investigating the associations between insulin resistance and resistance exercise in subjects without diabetes as well as associations between mental distress and physical activity in U.S. adults.

**References**

References for this article can be found at certification.acsm.org/cn-q4-2013

**Suggested Resources.**


American Diabetes Association www.diabetes.org
SHOULDER PAIN ATTRIBUTED TO WEIGHT-TRAINING: PREVENTATIVE MEASURES

By Morey J. Kolber, PT, Ph.D., CSCS; William J. Hanney, DPT, Ph.D., ATC; CSCS; Melissa Corrao, DPT, ATC, CSCS; and Eric J. Chaconas, DPT, FAAOMT, CSCS

Introduction
The popularity of weight-training (WT) is evident by the more than 45 million Americans who engage in strength training regularly. The health and fitness benefits ascribed to WT are not without risk, as evident by the documented injuries associated with WT. The shoulder complex in particular, comprises a significant proportion of all WT reported injuries and disorders. Evidence exists to suggest that approximately 60% of individuals who participate in WT will experience pain at some point during exercises. Although the etiology of shoulder pain is multifactorial, descriptive epidemiological reports have identified the presence of modifiable risk factors directly related to training patterns. The purpose of this article is to provide training recommendations designed to mitigate the risk of shoulder pain and injury.

Background and Modifiable Risk Factors
Numerous risk factors have been implicated in the etiology of WT induced shoulder injuries. These risk factors range from improper use of equipment, improper form, and undesirable exercise selection. From a risk perspective, a moderate to strong association has been found between reports of shoulder pain during WT and those who perform certain exercises. In particular, evidence suggests that individuals who perform either behind the neck latissimus pull-downs or military presses in their training regimen are more likely to experience shoulder pain during training. From a clinical perspective, WT participants who perform exercises such as behind the neck military presses or latissimus pull-downs that require the “high-five or 90/90” position (Figure 1) are more likely to present with clinical characteristics of anterior shoulder instability (ASI). Moreover, evidence suggests that individuals who perform lateral deltoid raises to a height above shoulder level are likely to present with clinical characteristics of shoulder impingement. On the contrary, evidence exists to suggest that those who routinely perform strengthening exercises for the external rotators are less likely to have shoulder pain during WT.

Recommendations
The incidence of shoulder pain attributed to WT may be attenuated through proper form and modifications to common exercises deemed to increase injury risk. Although the evidence for training modifications is still in its infancy, overarching recommendations do exist. Essentially, it is recommended that WT participants avoid the “high-five or 90/90” position during military presses or latissimus pull-downs that require the “high-five or 90/90” position (Figure 1) are more likely to present with clinical characteristics of anterior shoulder instability (ASI). Moreover, the authors recommend modification to reduce the potential for pain and injury.

Military Press. The military press exercise places the shoulder directly in the high-five position (Figure 1). The modification recommended for this exercise is to bring the barbell to the front making contact at the chest. When using dumbbells the recommendation is to keep the elbows anterior to the shoulder and in the scapular plane (Figure 2) while pressing overhead.
Behind the Neck Latissimus Pull-Down. When performing the latissimus pull down behind the neck the individual assumes the high-five position which similar to the military press is associated with both shoulder pain and ASI. This exercise can be modified by performing the pull-down to the front, which would minimize the unfavorable end-range 90/90 position.

Lateral Deltoid Raises. The lateral deltoid raise exercise increases the likelihood of rotator cuff impingement when performed with the elbows above 90 degrees (Figure 3A). It is recommended that individuals desiring to perform this exercise limit the angle to which they raise their arms. Specifically, we recommend that individuals limit the end range of the exercise to a position below shoulder height (Figure 3B).

External Rotator Strengthening. The external rotators (posterior muscles of the rotator cuff) function to stabilize and steer the humeral head and in many instances prevent impingement with overhead activity. Standing shoulder external rotation strengthening is a favorable exercise that has been shown to decrease the likelihood of experiencing shoulder pain during WT. This exercise can be performed with the cable column or resistance bands/tubing. A towel should be placed between the elbow and the trunk for proper form. The arm, once in position is then rotated out as shown in Figure 4 and then returned back to the starting position.

Conclusion
Despite the well-known health and fitness benefits attributed to WT, participation is not without risk as the prevalence shoulder pain among participants exceeds that of the general population.

The ability of clinicians and strength and conditioning professionals to recognize “at-risk” training patterns requires an awareness of documented injury trends and risk factors. Addressing modifiable risk factors, such as the high-five position commonly assumed during upper extremity exercises, as well as exercises that promote impingement may serve to prevent and/or minimize shoulder pain attributed to WT. Lastly, evidence suggests that the performance of external rotator strengthening may offer a protective effect and decrease the prevalence of WT-induced shoulder pain.

Figure 3: A (picture to left) illustrates improper form as arms are elevated beyond 90° (shoulder height). B (picture to right) illustrates proper form with arms elevated to an angle just below shoulder height, therefore minimizing risk of impingement.

Figure 4: Standing shoulder external rotator strengthening. Exercise begins with tension in cable/resistance band and forearm resting on stomach. The arm is then externally rotated out as shown and then returned to the start position.

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References
References for this article can be found at certification.acsm.org/cn-q4-2013.
ACSM’s CCRB (continued from page 2)

Personal Trainer examination and is working on an international version of the ACSM Health Fitness Specialist examination.

The CCRB expanded and made a more effective and coordinated connection between ACSM certifications and other related ACSM activities. The chairs of the CCRB Personal Trainer and Health Fitness Specialist sub-committees were appointed to the 2014 Health & Fitness Summit Program Committee. The CCRB submitted proposals, which were subsequently accepted, for presentations at both ACSM’s Health & Fitness Summit & Exposition and ACSM’s Annual Meeting. The future of the degreeed exercise professional will be presented at both meetings and the presentation is sure to spark discussion among certified professionals.

The most important activity that the CCRB engaged in during 2013 was strategic planning for advancing the profession of the exercise science degree professional. Much of the year was spent collecting data and discussing strategies that will best help elevate the value of and regard for degreeed exercise professionals. While a comprehensive strategic plan is still being developed, several important steps have been identified. In order to move the profession forward, we need to create a unified nomenclature for the field so that degreeed exercise professionals are easily identified by employers and the general public. We also need to better delineate the scopes of practice for our certified professionals to clarify who has the appropriate training to work with individuals with and without health challenges and those with diagnosed disease. Increasing the number of academic programs that are accredited by the Commission on Accreditation for the Exercise Sciences under the direction of the Commission on Accreditation of Allied Health Education Programs is important as it will help to create a recognized academic standard for the entire field. All other health care professions have accreditation, making it an essential step in establishing exercise science as a profession. Promoting licensure for the clinical exercise physiologist is another important strategic priority. Clinical exercise physiologists have been active in retaining their established roles in clinical programs, but are challenged from multiple directions. Major issues include lack of licensure and the inability to bill insurance directly for services.

In 2014, the CCRB will continue to work hard on behalf of all certified professionals. The plans are already underway to keep ACSM certifications the best in the industry and to help improve the future for the exercise professional.

About the Author
Deborah A. Riebe, Ph.D., FACSM, is a professor and chair of the Department of Kinesiology at the University of Rhode Island. Dr. Riebe is a past president of the New England Chapter of ACSM and is the current chair of ACSM’s Committee on Certification and Registry Boards. Her research focuses on promoting physical activity in special populations, with an emphasis on obesity and aging.

Legal Liability (continued from page 7)

loss reduction strategies that mitigate an injury once it occurs. Although the major benefit of risk management is to minimize legal liability exposures, injuries, and subsequent litigation, there are many other benefits that result from such an effort: improving the quality of programs/services and enhancing the reputation of the exercise profession. For example, to earn the respect of health care providers who are being encouraged to refer their patients to fitness programs through the Exercise is Medicine® (EIM®) initiative, it will be essential that exercise professionals provide safe and effective programs — and that is accomplished only through the development and implementation of sound risk management strategies.

ACSM’s Certified News (continued from page 8)

About the Author
Margaret Moore (Coach Meg), MBA, is the founder & CEO of Wellcoaches Corporation, a strategic partner of ACSM, widely recognized as setting a gold standard for professional coaches in health care and wellness. She is co-director of the Institute of Coaching, at McLean Hospital, an affiliate of Harvard Medical School and co-directs the annual Coaching in Leadership & Healthcare Conference offered by Harvard Medical School. She co-authored the ACSM-endorsed Coaching Psychology Manual, the first coaching textbook in health care and the Harvard Health Book published by Harlequin: Organize Your Mind, Organize Your Life.

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