American College of Sports Medicine

ACSM FIT SOCIETY® PAGE

A Quarterly Publication of the American College of Sports Medicine

RESISTANCE TRAINING

Contemporary Issues in Resistance Training: What Works?

by Robert D. Chetlin, M.S., CSCS, HFI, West Virginia University School of Medicine

Resistance training, also known as weight training or strength training, has gained great popularity in recent years, largely due to its appeal and positive impact on many diverse populations, such as athletic, recreational and clinical communities. Resistance training has benefited young and old, men and women, both fit and not-so-fit. Additionally, several different types of training programs have been used with varying degrees of success – circuit training, forced reps, multiple set, single set, split routine – just to name a few. Of course, the issue frequently raised with so many different types of approaches is how to choose an appropriate program for a given individual. Furthermore, trainees desire to know what new or innovative directions have been developed in the area of strength training. The truth is, developing a sound and effective resistance training program for a given individual can be a challenging task. The amount of available information about weight training is staggering and can make the mission of developing a sound program a pretty overwhelming prospect. Keeping this in mind, it's essential to cover a few of the important, basic concepts that may produce the optimal individual responses to a resistance training program.

"SAID" training

SAID refers to "specific adaptation to imposed demand," a principle long ago validated in the exercise science community. This standard maintains that the kind of demand placed upon the body will control the training adaptation that will follow. If the purpose of the training program is to become stronger and increase muscle size (i.e., hypertrophy), then performing 25-rep sets at low or very low intensity (i.e., <60-70 percent of maximal strength or 1-repetition maximum (1-RM) will not produce the desired results. In this instance, a program incorporating three to six sets of four to eight reps at approximately 85 percent of 1-RM would positively affect the acquisition of strength and size. If one is formulating a program for an athlete in a particular sport, the SAID principle dictates that the most effective resistance exercises will, as closely as possible, resemble the movement patterns of the athlete's event.

For example, a shot putter would use exercises that emphasize muscle recruitment in a fashion similar to the shot put movement. Since the shot put is an explosive athletic maneuver requiring great power, cleans, snatches, presses, and high pulls might be prescribed for this

(Continued on page 12, see Contemporary Issues)

Inside

AMERICAN COLLEGE OF SPORTS MEDICINE • FOUNDED 1954 •

www.acsm.org

ACSMFIT SOCIETY®

Letter from the Editor

Welcome to the Fall 2002 issue of the Fit Society Page. In this edition of the newsletter, sports medicine and exercise science experts examine *resistance training for improving health and performance*. If you are interested in learning how to develop a safe and effective resistance training exercise program, this is the issue for you. If you have children who are showing an interest in participating in a resistance training program, you will want to read the ACSM Current Comment on youth strength training included in this issue. Another feature article this quarter provides an explanation of how supplementation can help maximize the effectiveness of a resistance training program. Additionally, Winter 2002 Olympic athlete and ACSM member Werner W.K. Hoeger, along with co-author James R. Moore, M.S., help us begin our training program for outdoor winter activities. Finally, we have included the second in a two-part series on fat burning aids. As always, we have regular features including the *Athlete's Kitchen* and our popular *Question and Answer* section.

We hope you enjoy this issue of Fit Society Page and find information that you can use to enhance you and your family's health and wellness. If you have any questions or comments, please be sure to contact us.

Jeffrey A. Potteiger, Ph.D., FACSM
Editor, *ACSM Fit Society® Page*
Email: jpottei@mail1.vcu.edu

American College of Sports Medicine
FIT SOCIETY® PAGE

ACSM is the world's largest association devoted to sports medicine and exercise science. The College's mission is to promote and integrate scientific research and practical applications of sports medicine and exercise science to maintain and enhance physical performance, fitness health, and quality of life.

For more information on subjects discussed in this issue and/or a catalog of all ACSM publications, please send a self-addressed, stamped envelope to: American College of Sports Medicine, P.O. Box 1440, Indianapolis, IN 46206-1440.

Q&A with ACSM

by Bryan W. Smith, M.D., Ph.D., FACSM

Q: My child is eight years old and wants to work out with me at the gym. Is it safe for him to do weight training with me?

A: A well-designed and supervised strength training is safe for pre-pubertal children. It's important to recognize that your child's muscles will not get larger because he or she has not reached puberty. However, he or she will get stronger because of increased use of muscle fibers. Your instructor at the gym should be of help. Make sure maximal lifting is not included since this may be harmful in pre-pubertal children.

Q: Should pregnant women engage in weight training?

A: Both the Centers for Disease Control and the American College of Sports Medicine advocate daily moderate exercise during pregnancy. However, heavy weight training is discouraged. The American College of Obstetrics and Gynecology further recommend that pregnant women should avoid exercise in a supine position as much as possible, due to the possibility of compromising blood flow to the fetus.

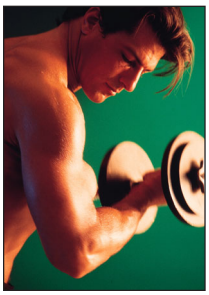
Q: When you start a weight training program, do you need to increase the amount of protein you consume in your diet?

A: Not usually, if one eats a regular, well-balanced diet. With training extremes, or if one gets a minimally adequate amount of protein in their diet (e.g. vegetarians), there may be a need to increase protein intake. An adequate protein intake per day is 1.5 grams of protein per two pounds of body weight.

Q: Why should one consider adding resistance training to their workout routine?

A: Maintenance of strength is important for normal healthy living. As we age, we can lose one percent of our strength per year after the age of 25. Strength training, as a component of an overall fitness plan, plays an important role in the development of fitness as well as prevention of injury.

Feature



BUILDING STRENGTH SAFELY
Focus on proper technique in resistence training

by Michael Bird, Ph.D.

Key words: weight training, technique, safety, range of motion, balance

Resistance training programs are used to achieve many different goals, such as performance improvement, injury rehabilitation, muscle tone improvement, and strength improvement. While injury risk is influenced by lifter experience and previous injury history, the best assurance of safe resistance training is the use of proper lifting techniques, which can help avoid overuse injuries such as bursitis and patellar tendonitis and acute injuries such as muscle strains or broken bones.

Proper lifting technique is based on knowledge of what joints and muscles a lift is specifically designed to emphasize. Correct lifting techniques will only use those joints and muscles and not others. For example, a seated row emphasizes the posterior deltoid, latissimus dorsi, and teres major at the shoulder and the rhomboids and trapezius at the shoulder girdle. Some lifters will use the erector spinae muscles of the lower back to start the lifting motion, which reduces the effectiveness of the lift for the muscles it is intended to stress. Using other joints and muscles to "cheat" and complete any lift decreases the long-term effectiveness of the lifting program. In some cases, the inappropriate muscles used may be more susceptible to injuries as higher weights are reached. For example, performing power squats or hack squats using too much range of motion in the back (with a reduced leg range of motion) increases the risk of injury to the musculoskeletal structure of the lower back, and this risk increases as the weight or intensity of the lift increases.

Proper range of motion for the joints involved is also important in safely performing lifts. The most common problem is inadequate range of motion. Using less range of motion allows lifters to achieve greater weights sooner, but sacrifices the overall development of the muscle and increases the likelihood of injury when the muscle is stressed at a point of the range of motion that is untrained. Although less common, using too great a range of motion is also a risk. Exceeding the range of motion of a joint puts great stress on the muscles, tendons, and ligaments that provide joint stability. Lifting with fast or jerky motions will lead to greater range of motion than desired and is one reason most lifts should occur in slow, controlled manners. When performing the lifting exercises, reduce the weight if the proper technique or range of motion cannot be maintained during a lift. Often, lifters exhibiting poor technique or range of motion do so because the weight is too great.

Good Balance is Key

Balance is also an important part of safe lifting. In overhead free weight lifts this is obvious, as the bar must remain in control. Novice lifters often struggle as much with bar control and balance as they do with lifting the weight. Fortunately, this problem is quickly overcome with practice. Body balance is also important in many lifts and often relies on a stable body position, proper posture, and appropriate settings for seats or arms on machines. In performing squats, for example, balance and weight control are essential. When these are lost during this exercise, many of the smaller muscles used for postural control may be easily injured due to the great forces suddenly applied to them. With either bar or body balance issues, near-maximal lifts should be avoided until the lifter has sufficient skill to maintain control. Using less weight, higher repetitions, and proper lifting technique will help those needing balance improvements.

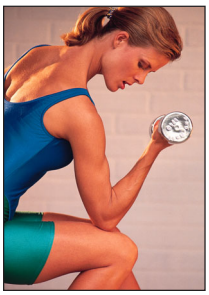
Resistance training programs should also use a balanced design to avoid some injuries. Too much emphasis on one set of muscles with inadequate emphasis of the antagonists (the muscles performing the opposite action) can lead to a strength imbalance and an increased risk of injury. For example, many lifters will perform a preferred lift such as leg extensions, but avoid a less-preferred lift such as leg curls. This resulting strength imbalance between the quadricep muscles and hamstring muscles increases the risk of muscle pulls and strains.

Fatigue is a Risk

Fatigue affects lifting technique, range of motion, the joints and muscles used, and balance. When a lifter becomes fatigued within a set, the last repetitions may not maintain proper technique, may lose range of motion, may incorporate other muscles or joints, and balance may be lost. Regardless of lifting experience, this situation has greater risk for injury. Lifting to fatigue or failure is a common component of lifting programs. A spotter is particularly important for safe lifting performance during fatigue. Many overhead lifts and multi-joint lifts like the bench press and squat are more safely performed with a spotter. Many other lifts do not necessitate a spotter, but benefit from them when the weight is particularly heavy for the lifter or the set is being performed to failure. Spotters should be familiar with the lift and its technique, the

(Continued on page 13, see Resistence Training)

Feature



WOMEN AND RESISTANCE TRAINING

The Right Program Brings Results for Females Who Train

by Gary R. Hunter, Ph.D., CSCS, FACSM

Women can gain a number of very positive benefits from participating in a well-constructed resistance training program. Many women, however, do not put enough effort into their training. They mistakenly believe that training with low weights for high repetitions (greater than 20) will achieve optimal increases in energy expenditure and body composition. The main advantage in resistance training over other forms of training is the ability to progress the resistance. To achieve optimal gains in muscle size and strength, women must train at a relatively high resistance (usually somewhere between 65-80 percent of maximum) for six to 12 repetitions during two to three workouts each week. At least some of the sets each week must be to exhaustion or near exhaustion. Resistance should be increased when a repetition goal (somewhere between six to 12 repetitions) for an exercise is reached.

Although women can definitely increase muscle size, it should be understood that there is little chance of a woman becoming a behemoth and ending up with a body like Arnold Schwartzenegger. Without drug use or some very specialized training is undertaken for many years, women who resistance train normally just become very fit looking. During maturation, women develop much less muscle mass than men. This means that an untrained woman has fewer muscle cells than an untrained man. This is especially the case for the shoulders and arms. Most if not all muscle growth in an adult occurs through increases in size of existing muscle cells, so the total potential for growth in a woman is less than in a man, especially in the arms and shoulders. Other factors may contribute to a slower increase in muscle size in women following a resistance training program, but they are largely unknown. On the average, a woman can expect about a 10 percent increase in muscle size for a muscle that has been resistance trained for three to six months. Strength will normally increase between 30-50 percent. Quite a bit of variability in how much a woman can expect to increase in strength and muscle size exists, with some women increasing in muscle size very little and others increasing as much as 20 percent. Factors such as genetic predisposition, nutrition, general health of the woman and effort put into the training probably contribute to the variation.

Even though women may not have quite as much potential for strength and muscle size improvement as men, they actually may have more to gain from a functional standpoint. Women are much weaker than men. When matched for body size, the average untrained woman is 35-45 percent weaker in the arms and shoulders and 10-25 percent weaker in the legs and hips than untrained men. Consequently, untrained women generally experience more difficulty in doing daily tasks such as walking, climbing stairs, and carrying children or groceries. Recent research suggests that difficulty in doing these tasks predispose individuals to decreasing free-living physical activity. A reduction in physical activity has two very important negative outcomes. First, low levels of physical activity are associated with increased likelihood of weight gain, and second, the decrease in physical activity can cause a further decrease in muscle mass, fitness and increase in difficulty during physical activity. The problem is complicated with the further increase in difficulty for moving a heavier body that occurs with weight gain and the loss of muscle mass and fitness that naturally occurs with age. By the early 50s, and certainly by the 60s, most sedentary women experience increased difficulty during physical activity as well as decreased quality of life. Research has demonstrated that ease of performing tasks such as carrying a child or bag of groceries, standing from a chair, and walking can be improved by 40-60 percent following a resistance training program, improving the function of a 65-year-old woman to a level similar to that of a sedentary 30-year-old woman.

The Aging Issue

The amount of energy that we expend decreases as we age. This is partly due to a decrease in muscle mass, but it also seems to be partly due to an independent aging effect. Muscle tissue is about three times more metabolically active than fat tissue. It is not unusual for a woman to gain two to four pounds of muscle following four to six months of moderate resistance training, causing energy expenditure at rest to increase 100 kcal or more/day. Further, modest increases in total energy expenditure may occur because of the energy expended during training and increased participation in a more active lifestyle. This may be important

(Continued on page 13, see Women)

ACSM Current Comment

YOUTH STRENGTH TRAINING

by Avery D. Faigenbaum, Ed.D. (Chair) and Lyle J. Micheli, M.D., FACSM

Editor's Note: "Youth Strength Training" is a title that appears in the ACSM Current Comment series. Current Comments are proactive statements concerning sports medicine and exercise science-related topics of interest to the public. They are written in understandable language to be relevant and helpful to the general public. For more information on Current Comments, please visit the ACSM Web site at http://www.acsm.org/health%2Bfitness/comments.htm.

The following is an update from Current Comment co-author, Avery Faigenbaum, Ed.D., FACSM

Scientific evidence and clinical impressions continue to indicate that strength training should be part of a comprehensive health-enhancement strategy for all boys and girls, including those with a disinterest in physical activity. All major medical and fitness organizations now support participation in supervised youth strength training activities, and a growing number of children and teenagers are now strength training in physical education classes and after-school programs.

Participation in a youth strength training program, along with other physical activities such as riding a bike and swimming, gives inactive children and teenagers yet another opportunity to improve their health and well-being. From a public health perspective, we should increase the number of children and teenagers who participate in physical activities that enhance and maintain cardiorespiratory and musculoskeletal health.

Fitness training has traditionally emphasized aerobic exercise such as running and cycling. More recently, the importance of strength training for both younger and older populations has received increased attention, and a growing number of children and adolescents are experiencing the benefits of strength training. Contrary to the traditional belief that strength training is dangerous for children or that it could lead to bone plate disturbances, the American College of Sports Medicine (ACSM) contends that strength training can be a safe and effective activity for this age group, provided that the program is properly designed and competently supervised. It must be emphasized, however, that strength training is a specialized form of physical conditioning distinct from the competitive sports of weightlifting and powerlifting, in which individuals attempt to lift maximal amounts of weight in competition. Strength training refers to a systematic program of exercises designed to increase an individual's ability to exert or resist force.

Children and adolescents can participate in strength training programs provided that they have the emotional maturity to accept and follow directions. Many seven and eight-year-old boys and girls have benefited from strength training, and there is no reason why younger children could not participate in strength-related activities, such as push-ups and sit-ups, if they can safely perform the exercises and follow instructions. Generally speaking, if children are ready for participation in organized sports or activities, such as Little League baseball, soccer, or gymnastics, then they are ready for some type of strength training.

The goal of youth strength training should be to improve the musculoskeletal strength of children and adolescents while exposing them to a variety of safe, effective and fun training methods. Adult strength training guidelines and training philosophies should not be imposed on youngsters who are anatomically, physiologically or psychologically less mature. Strength training should be one part of a well-rounded fitness program that also includes endurance, flexibility and agility exercises.

Properly designed and competently supervised youth strength training programs may not only increase the muscular strength of children and adolescents, but may also enhance motor fitness skills (e.g., sprinting and jumping) and sports performance. Preliminary evidence suggests that youth strength training may also decrease the incidence of some sports injuries by increasing the strength of tendons, ligaments and bone. During adolescence, training-induced strength gains may be associated with increases in muscle size, but this is unlikely to happen in prepubescent children who lack adequate levels of muscle-building hormones. Although the issue of childhood obesity is complex, youth strength training programs may also play an important role in effective weight loss strategies.

There is the potential for serious injury if safety standards for youth strength training such as competent supervision, qualified instruction, safe equipment and age-specific training guidelines are not followed. All youth strength training programs must be closely supervised by knowledgeable instructors who

(Continued on page 14, see Youth)

Feature

MAXIMIZING RESISTANCE TRAINING WITH SUPPLEMENTATION

by Matthew W. Hulver, Ph.D. and John P. Thyfault

Editor's Note: This article is written by ACSM members, and was originally printed in Olympic Coach *magazine, Fall 2001.*

Resistance training has become an important component of most athletic conditioning programs. Scientific research demonstrates that resistance training results in improved muscular strength and size. It has also been found that resistance training increases the concentration of various hormones and growth-promoting agents within the body that may contribute to this improved muscular strength and size. Post-workout supplementation has been suggested as a potential method of improving the hormonal status within the body after a resistance training session, thus contributing to improved recovery and potential muscle growth.

The terms protein synthesis and protein degradation refer to the building of skeletal muscle and the breakdown of skeletal muscle, respectively. Hormones are substances produced in one place of the body and transported to tissues where physiological actions are stimulated. There are two different classifications of hormones that alter muscle growth: anabolic and catabolic. Anabolic refers to the process of building or synthesizing tissue and catabolic refers to the process of degradation or breakdown of tissue. For example, when someone is said to be in an anabolic state, they are in a state in which muscular growth is occurring. But if someone is in a catabolic state, they are in a state in which muscle is being broken down. The major anabolic hormones in the human body are growth hormone, testosterone, insulin-like-growth factor I (IGF-I), and insulin. The major catabolic hormone is cortisol.

Hormones

Growth hormone is released from the pituitary gland and is responsible for bone, cartilage, and muscle growth. Testosterone is a hormone that is produced and released from the testicles in males and also from the adrenal glands in males and females. The majority of male testosterone is produced in the testicles, while small amounts are produced in the adrenal glands of both sexes. The function of testosterone is to interact with the cell nuclei and increase protein synthesis. Insulin-like-growth factor I is a hormone that is primarily produced in the liver; it is now believed that it may also be produced locally within a cell in response to a stimulus such as resistance training. Insulin-like-growth factor I is responsible for inducing protein synthesis in bone, cartilage, and muscle. Insulin is a hormone that is produced in the pancreas; its primary function is to stimulate cells to absorb carbohydrates and amino acids from the blood, which are used for energy and the building of protein. Cortisol is a hormone that is produced and released from the adrenal glands and stimulates the breakdown of stored energy such as carbohydrates, fat, and protein. The release of cortisol is stimulated by stress, or when levels of carbohydrate in the blood are low and the cells of the body are in need of energy. Stress refers to exercise, such as resistance training, or fear and anxiety.

Resistance Training and Hormones

Many scientists have investigated the effect of resistance training on the anabolic and catabolic hormones of the human body. A majority of that research has focused on growth hormone, insulin-like-growth factor I, and testosterone, all of which increase in concentration as a result of resistance training. The effect resistance training has on the concentrations of these hormones in the blood is dependent on the type of resistance training program. Two common types of resistance training are power lifting and bodybuilding. A power lifting program usually involves the use of heavier weight (90 percent of one repetition maximum, 1RM) and fewer repetitions (five repetitions) with long rest periods (three minutes) between sets. A bodybuilding design generally employs lighter weight (80 percent of 1RM) and higher repetitions (12 repetitions) with short rest periods (one minute or less) between sets. Research has shown that a bodybuilding design produces greater increases in growth hormone, insulin-like-growth factor I, and testosterone post-workout when compared to the power lifting design. In addition, these hormones are elevated in a resting state in resistance-trained individuals when compared to untrained individuals. The increased levels of these hormones in the blood as a result of resistance training provide for an anabolic state, which is conducive to increased protein synthesis. However, the release of the hormone cortisol is also increased in response to resistance training. High levels of this hormone lead to protein degradation, which leads to decreased muscular growth and strength.

Dietary Considerations for Resistance-Trained Athletes

A balanced diet in conjunction with a resistance training program will aid the

(Continued on page 7, see Supplementation)

Supplementation

(Continued from page 6)

muscle building process. Many athletes do not eat enough calories throughout the day to properly build muscle tissue. Athletes who wish to increase size and strength must be in a positive energy balance, which occurs when the athlete is consuming more calories than the body is burning throughout the day. The theory behind this indicates that the excess calories will be used for building muscle tissue. Many athletes do not obtain the proper proportion of carbohydrates, proteins, and fats in their diets. Carbohydrates are important for fueling the body and the brain to perform daily activities, as well as strenuous training and sporting events. Protein, made of amino acids, is used for synthesizing all types of human tissue, including muscle. Obtaining dietary fat is important for athletes because it is used in the production of various hormones, such as testosterone.

Potential Benefits of Post-Workout Supplementation

A potential benefit of post-workout nutritional supplementation is the provision of nutrients to the body when they can be most utilized. Recently, researchers have examined the effects of beverages containing carbohydrate alone and/or carbohydrate and protein consumed immediately following resistance training exercises.

Muscle glycogen, a readily available stored form of carbohydrate within the muscle, is used for energy during a resistance training workout. In fact, glycogen stores may be severely depleted following a resistance training workout. The consumption of a carbohydrate or a carbohydrate and protein supplement immediately and one hour after exercise will significantly restore muscle glycogen levels. Increasing the rate at which glycogen is restored may benefit an athlete when he or she is training more than once a day, or training late in the evening and then early the next morning.

Post-workout nutritional supplementation most importantly affects hormonal levels within the body following resistance training. The consumption of a carbohydrate or a carbohydrate and protein mixture following a resistance training workout will stimulate an increase in blood insulin levels. The increased insulin release is primarily stimulated by carbohydrate intake, but protein intake has also been shown to have a slight stimulatory effect. Insulin stimulates glucose and amino acid transport into the muscle, as well as limited protein breakdown. If insulin levels are immediately raised following a resistance training session, the subsequent protein breakdown following resistance training could be slowed, therefore magnifying the effects of protein synthesis, and creating an environment for muscular growth.

Researchers have also found increased amounts of circulating growth hormone in subjects who consumed a carbohydrate and protein supplement post-workout when compared to individuals who consumed no supplement. In addition, there appears to be a decrease in testosterone levels within the blood in subjects who consumed a supplement. This decrease in testosterone may be a result of increased absorption of carbohydrate and protein by muscle tissues in response to increased insulin levels. Thus, the effects of resistance training may be magnified by incorporating post-workout carbohydrate and protein supplementation by promoting an increased anabolic environment.

It has also been found that following resistance training, muscle fibers absorb a greater amount of amino acids from the bloodstream and that this increased uptake may be present for up to 48 hours following the training session. Therefore, the presence of an increased level of amino acids within the blood stream, which will follow taking a protein supplement following resistance exercise, may contribute to an increase in protein synthesis. In fact, protein intake immediately after resistance training may be more important for muscular growth than if ingested later.

Cortisol, a catabolic hormone that stimulates the breakdown of muscle protein, is released in high amounts during and after resistance exercise due to the increased level of stress put on the body, as well as a decrease in blood glucose concentration. If blood glucose levels can be maintained or quickly restored after a workout by consuming a carbohydrate beverage, cortisol release can be reduced. In fact, research on endurance activities has shown that carbohydrate supplementation can reduce the release of cortisol into the blood stream. It is possible that carbohydrate supplementation may have the same limiting effect upon the release of cortisol following resistance training. Not only does nutritional supplementation increase the amount of anabolic hormones released following a workout, it could also decrease the release of the catabolic hormone cortisol. These effects allow for a much-enhanced anabolic environment.

The optimal amount or type of nutrient to be consumed after a workout has not been determined. It is clear that a post-workout supplement should contain both carbohydrate and protein, as both nutrients play a key role in gaining muscular size and strength as well as enhancing recover for the next bout of exercise. While varying amounts of carbohydrate and proteins in the post-workout supplementation have been used, there has been no clear-cut amount or proportion shown to have optimal results. Based on the existing knowledge, post-workout supplements should supply a 2.5-3-to-one ratio of carbohydrate to protein. There are various drinks, mixes, and shakes available on the commercial market that can be quickly consumed

(Continued on page 14, see Supplementation)

Series

THE SKINNY ON "FAT BURNERS"

PART II

by Katherine Beals, Ph.D., R.D.

Editor's Note: This article is the second in a two-part series. Part I appeared in the Summer 2002, Nutrition issue, and profiled thermogenic products, Conjugated Linoleic Acid and Chromium Picolinate. It can be read by accessing the ACSM Fit Society® Page *newsletter archives page at http://www.acsm.org/health+fitness/fit_society.htm.*

Lose weight without dieting or exercising! Turn your body into a fat burning machine! Lose the fat, keep the muscle! These are just a few of the claims being made by the marketers of "fat burning" supplements. If they sound too good to be true, it's because they are. Most of these claims are not based on scientific evidence, but rather pseudoscience, half-truths, and sometimes outright lies! Indeed a good many of the currently popular "fat burning" supplements contain substances that are at best completely ineffective and at worst potentially dangerous. The most popular "fat burning" supplements on the market today can be placed into three broad categories: (1) those that claim to increase fat oxidation and/or metabolic rate; (2) those that inhibit the absorption of dietary fat; and (3) those that inhibit the synthesis of fat.

7-keto-DHEA

What is it?

7-keto-DHEA, which is short for 3-Acetyl-7-Oxo-dehydroepiandrosterone, a naturally occurring metabolite of DHEA (dehydroepiandrosterone). DHEA is an adrenal hormone that functions as a metabolic precursor for the sex hormones testosterone and estrogen. Because 7-keto-DHEA is a metabolite of DHEA, which is a precursor to testosterone, it is marketed as an anabolic agent, which means it produces an increase in lean body mass. It has also been promoted as a weight loss aid for its supposed thermogenic effects.

Does it work?

As is the case with so many of the "fat burning" supplements, animal research seems to support the effectiveness of 7-keto-DHEA, while studies using human subjects remains inconclusive. In lab animals 7-keto-DHEA has been shown to "normalize an induced hypothryroid state" (increase energy expenditure), improve memory, and enhance immune function. To date, only one study has examined the effects of 7-keto-DHEA supplementation on body weight and composition in humans. In this study, 30 overweight adults underwent a structured cross-training exercise program and were supplemented with 200 mg/d 7-keto-DHEA or placebo. At the conclusion of the two-month trial, the supplemented group lost significantly more weight and body fat than the placebo group. However, it should be noted that there were some serious flaws in the research study design that are likely responsible for the "positive" findings. First, the group receiving the supplement was significantly heavier and fatter than the placebo group at the outset of the study. It is well-known weight loss is positively associated with initial body weight (those who have more weight to lose typically lose more weight). In addition, body composition was measured via skinfold calipers (which, as already mentioned, have a fairly large measurement error rate), and although the authors noted that dietary intake was monitored throughout the study, they did not report any of the data. Finally, the article appears not in a peer-reviewed journal but as an abstract in an electronic journal.

Is it safe?

7-keto-DHEA appears to be safe in doses of ≤ 200 mg/d over the short-term. However, the long-term safety of 7-keto-DHEA for humans has not been evaluated. Moreover, because it is a metabolite of DHEA, it could potentially produce similar side effects at high doses over a prolonged period of time (e.g., oily skin, acne, body and facial hair growth, liver enlargement, decreased HDL-cholesterol levels, and aggressiveness).

The Bottom Line

There is currently insufficient scientific evidence to justify the use of 7-keto-DHEA for weight loss or muscle gain. Moreover, it should be noted that the only human trial used 200 mg/d dose of 7-keto-DHEA while most commercial supplements provide only about 50 mg/d.

Pyruvate

What is it?

Pyruvate is a three-carbon sugar ("triose") derived from the breakdown of glucose. Because glucose, the primary sugar used by the body cells for energy, is broken down into pyruvate, it has been hypothesized that supplementing with pyruvate will elevate energy levels and decrease appetite, thereby enhancing weight loss and reducing weight regain following a period of dieting. Pyruvate is often combined with a mineral (e.g.,

(Continued on page 9, see "Fat Burners")

"Fat Burners"

(Continued from page 8)

sodium, calcium, magnesium) to provide stability and to aid in absorption from the stomach.

Does it work?

Pyruvate gained the interest and attention of scientists when it, along with another triose (dihydroxyacetone [DHA]), was shown to reduce the development of fatty liver in rats subjected to chronic alcohol feedings. Subsequent studies demonstrated that rats and pigs supplemented with the pyruvate/DHA combination lost weight and body fat, had an increased metabolic rate, and increased fat oxidation. The few studies conducted with human subjects have indicated that very large doses of pyruvate (22-90 g/d), when combined with very low-calorie diets (500-1000 kcal/d) can promote weight loss in morbidly obese individuals confined to a hospital metabolic ward. Nonetheless, the extreme experimental conditions render the research findings of little relevance to the average overweight person trying to lose a few pounds. It is also worth noting that the vast majority of studies demonstrating positive findings were conducted by a single researcher, who is also involved with the manufacturing and marketing of the product.

Is it safe?

Pyruvate, in the doses commonly found in supplements (~.5 -1 g/dose), poses little risk; however, at higher doses, such as those used in research studies, it has been shown to cause gastrointestinal disturbances, including abdominal bloating, cramping, gas, and diarrhea.

The Bottom Line

At $25-$60 per bottle (a two to three week supply), pyruvate is probably the most expensive fat-fighting supplement on the market. Moreover, the vast majority of commercial products contain less than or equal to one gram per serving, which is considerably less than the level shown to be effective in the clinical studies described above. In addition, none of the commercial products contain DHA as was used in the research studies. Add to this the fact that pyruvate and DHA must be combined with a very low calorie diet in order to be effective and you probably come to the conclusion (and rightly so) that this supplement is not worth the money.

Supplements that Claim to Inhibit Fat Absorption

Chitosan

What is it?

Chitosan is derived from Chitin, a dietary fiber found in the shells of crustaceans such as crab, shrimp, and lobster. It is touted as a remedy to reduce the absorption of dietary fat; thus, products containing chitosan promise you can enjoy all the high-fat foods your heart (and stomach) desire and then simply "flush away the consequences."

Does it work?

The majority of research on chitosan has been done in animals where it has been shown to effectively bind to fats in the digestive tract and prevent their absorption. The research in humans, however, is not nearly as encouraging. In a few loosely designed studies, chitosan did appear to amplify the effects of a low-calorie diet. However, more recent well-controlled studies have failed to support the efficacy of chitosan for weight loss, particularly in the absence of caloric restriction. For example, in a double-blind, randomized study, obese subjects taking chitosan (1000 mg/d) daily for 28 days lost no more weight than those consuming a placebo.

Is it safe?

Undigested fat has the potential to become fermented in the large intestine, thus causing gas, bloating, cramping and diarrhea. The possibility also exists that chitosan can bind the fat-soluble vitamins (A, D, E, and K) and carotenoids in the small intestine and reduce their absorption, thereby potentially promoting deficiencies of these vitamins. The National Toxicology Program has recommended that additional studies be conducted on chitosan to ensure that it is not posing a danger of nutrient deficiencies.

The Bottom Line

Chitosan appears to only be effective when used in conjunction with a reduced calorie, low-fat diet. Moreover, as is the case with many of the "fat burning" supplements, the dosages that have been shown to be effective in research studies are much higher than those found in the supplements at your local health food store. So if you are looking to increase your fiber intake, it is recommended that you forgo the chitosan and have a bowl of oatmeal instead!

Supplements that Claim to Decrease Fat Synthesis

Hydroxycitric Acid

What is it?

Hydroxycitric Acid (HCA) is the active ingredient found in two plants native to India, Garcinia cabogia and Garcinia indica. HCA has been incorporated into a variety of weight loss supplements (e.g., Citrin, CitriMax, Regulator), all claiming to inhibit fatty acid synthesis and thus fat storage, and suppress appetite.

Does it work?

In vitro, HCA has been shown to inhibit a key enzyme, citrate lyase, required for the

(Continued on page 15, see "Fat Burners")

Feature

OUTDOOR WINTER SPORTS: GET FIT TO PLAY

by Werner W.K. Hoeger, Ed.D., FACSM, Boise State University and James R. Moore, M.S., Idaho Sports Medicine Institute

The winter sports season is rapidly approaching. A good preseason training program will help make the season more enjoyable and prevent exercise-related injuries. Properly conditioned individuals can safely participate in winter sports and enjoy the activities to their fullest with few or no limitations. Sports injuries are often the result of low fitness and a lack of sport-specific conditioning. Many injuries occur when fatigue sets in following overexertion by unconditioned individuals.

Base Conditioning

Preactivity screening that includes a health history and/or a medical evaluation appropriate to your sport selection is recommended. Once cleared for exercise, start by building a base of general athletic fitness that includes aerobic fitness, muscular strength and endurance, flexibility, and adequate body composition (weight). The fitness base conditioning program should last a minimum of six weeks.

For aerobic fitness, select an activity that you enjoy (walking, jogging, cycling, step aerobics, cross-country skiing, stair climbing, endurance games) and train three to five times per week for a minimum of 20 minutes of continuous activity per session. Exercise to between 55 and 90 percent of your maximal heart rate (220 minus your age). For example, if you are 30 years old, the exercise intensity would be between 105 and 171 beats per minute [(220 - 30) X .55 and .90]. You should feel as though you are training "somewhat hard" at this intensity level.

Resistance (strength) training helps maintain and increase muscular strength and endurance. Select eight to 10 exercises that involve the major muscle groups of the body and train two or three times per week on nonconsecutive days. Select a resistance (weight) that allows you to do eight to 12 repetitions to near fatigue. That is, the resistance will be heavy enough so when you perform a set you will not be able to do more than 12 repetitions at that weight. Begin your program slowly and perform between one and three sets of each exercise. Recommended exercises include the bench press, lat pull-down, leg press, leg curl, triceps extension, arm curl, rowing torso, heel raise, abdominal crunch, and back extension.

Flexibility is important to maintain and enhance range of motion in the joints. Flexibility training can be done two to three days per week. Although various stretching techniques can be used, static stretching is preferred. Unless performed by trained personnel, other techniques (ballistic and assisted stretching) can lead to injury. Perform each stretching exercise four times and hold each stretch for 10 to 30 seconds. Examples of stretching exercises include the side body stretch, total body rotation, chest stretch, shoulder stretch, sit and reach stretch, groin stretch, quad stretch, heel cord stretch, and knee to chest stretch.

Body composition refers to the fat and non-fat components of the human body. Excess body fat hinders sports performance and increases the risk of injuries. Depending on the nature of the activity, fitness goals for body composition range from 12 percent to 20 percent body fat for men and 17 percent to 25 percent for most women.

Sport-Specific Conditioning

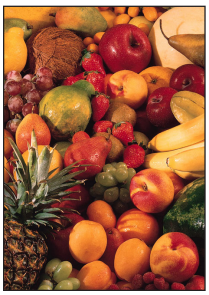
Once the general fitness base is achieved, continue with the program but make adjustments to add sport-specific training. This training should match the sport in terms of the aerobic/anaerobic, strength, muscle endurance, and range of motion requirements. During this sport-specific training, about half of your aerobic/anaerobic training should involve the same muscles used during your sport. Ideally, allocate four weeks of sport-specific training prior to the start of winter sports and continue this training throughout the season. Depending on the nature of the sport (aerobic vs. anaerobic — see below), once the season starts, winter sports participation can take the place of some or all of your aerobic workouts.

The next step is to look at the demands of the sport. For example, cross-country skiing and snowshoeing are aerobic activities; whereas alpine skiing, snowboarding, and hockey are stop-and-go sports that require a combination of aerobic and anaerobic activity (anaerobic exercise is of short duration and very high intensity). While aerobic training may be appropriate for cross-country skiing, it will do little to prepare your muscles for the high intensity moments found in combined aerobic/anaerobic sports.

Interval training, performed twice per week, is added to the program at this time. These intervals consist of a one-to-three work/rest ratio. Work at a fairly high intensity, for instance 15 seconds, followed by 45 seconds of low-intensity recovery. Be sure to keep moving during the recovery phase. Perform four or five

(Continued on page 16, see Winter Sports)

The Athlete's Kitchen



SPORTS NUTRITION UPDATE

by Nancy Clark, M.S., R.D.

The American College of Sports Medicine (ACSM) is the nation's largest professional organization for exercise scientists, sports nutritionists and other sports medicine specialists. Each May, experts from around the country and the world gather to present the latest information at the ACSM Annual Meeting. The following are some highlights from the May 2002 meeting in St. Louis.

Protein

Bodybuilders commonly wonder when is the best time to eat protein to optimize muscular growth. The latest research suggests that having some amino acids (the building blocks of protein) circulating in the blood while you are exercising can optimize the muscle-building process. This simply means eating a pre-exercise snack that includes a combination of carbs (for energy) and protein (for muscle building): cereal with milk, yogurt and a banana, bagel with peanut butter, trail mix (nuts and dried fruit), or a turkey sandwich. You need not run to the store to buy the latest protein bars or drinks; standard foods can do the job just fine!

Amenorrhea

Exercise scientists have questioned why some female athletes stop menstruating and others maintain regular menstrual periods despite a rigorous exercise program. According to Dr. Anne Loucks of Ohio University, amenorrhea (loss of the menstrual period) is caused by undereating. Women with amenorrhea fail to increase their calorie intake to account for the calories they burn during exercise. When the brain detects an energy deficiency, it immediately turns off the reproductive system.

If untreated, amenorrhea can lead to poor bone health, stress fractures and premature osteoporosis. The solution is to eat more calories, preferably a nice balance of whole grains, lean protein-rich foods, lowfat dairy products and healthful fats (salmon, nuts, peanut butter). For example, calories can be added by enjoying a yogurt for a morning snack the first week, then a half-cup of beans on a lunchtime salad the next week, potato with dinner the third week, etc. By gradually increasing calories over the course of three to five weeks, a woman can reverse the situation and not only be healthier (as indicated by regular menses), but also feel better and be better fueled for stronger workouts. Because these are not excess calories, they are unlikely to cause the women to "get fat." Rather, the body burns the fuel and becomes fully functional, as opposed to shutting down to conserve energy.

Anemia

Iron deficiency anemia ("iron poor blood") is a cause of needless fatigue, primarily among female athletes. Women are more likely to suffer from anemia than men because women tend to eat less red meat (the best source of dietary iron), lose iron during menstrual bleeding, and skip breakfast (i.e., fail to eat iron-enriched breakfast cereals). A little bit of iron can also be lost via sweat or intestinal bleeding, but according to Dr. Randy Eichner of the University of Oklahoma, this loss is minimal. Dr. Eichner believes sports do not cause anemia but rather unmask it. That is, a sedentary woman could be unaffected by having mild anemia, whereas the active woman would notice a difference in physical performance. Regular blood tests in competitive athletes can help detect shifts in iron levels and prevent anemia.

Epidemic of obesity

Obesity is a major public health concern: 25 percent of children are now classified as overweight (or at risk of overweight); 61 percent of American adults are overweight or obese. Sedentary behavior is a contributing factor. Because 73 percent of kids ages 12 to 17 years spend a significant amount of time surfing the Internet, Web sites are an excellent way to reach this audience. A new site, www.kidnetic.com, is helping kids and families get positive messages about ways to be more active and fuel their bodies healthfully. The program designers studied what motivates kids (looking better, performing better, having more energy to do fun things). Hence, the content focuses on these fitness "payoffs." This obesity prevention program should also pay off!

Muscle cramps

Anyone who has ever experienced severe muscle cramps wants to know how to prevent them. According to Dr. Michael Bergeron of the Medical College of Georgia, salt is a key cramp preventer. Having worked with numerous tennis players who exercise in extreme heat, Dr. Bergeron noticed athletes who suffer from cramps could resolve the problem by adding more salt to their daily diets. Case in point: a tennis player who regularly cramped badly, despite drinking plenty of fluids. His father had high blood pressure and consequently, the entire family ate a low sodium diet. By eating more pretzels, table salt and sports

(Continued on page 16, see Sports Nutrition)

Contemporary Issues

(Continued from page 1)

type of athlete. Shot putting also requires great coordinated stability through the legs, hips, back and abdominal region. Therefore, multi-joint multi-muscular strength-inducing exercises, such as the barbell squat, would be applicable to a program seeking to improve the ability to shot put. Activity-specific or sport-specific training also stems from the SAID principle. If one is an athlete training for a particular sport (e.g. baseball, basketball, hockey, football, tennis, golf) or an 80-year old grandmother rehabilitating from an injury and exercising to maintain an accustomed level of independence within her own house, then the training program should reflect the requirements of the given sport or activity.

Periodization

Periodization is perhaps the "mother" of all successful training principles. The scientific literature demonstrates the effectiveness of periodization time and time again. Periodization is the systematic variation of training specificity, intensity and/or volume to obtain long-term training and performance improvements. This strategy is based upon a transfer of training priorities from higher-volume and lower-intensity to lower-volume and higher-intensity through a series of training periods, referred to as cycles and phases. These pre-determined intervals emphasize various physiological adaptations such as muscular endurance, hypertrophy, strength and power. Incorporated into such a scheme is the element of rest and recuperation, where intensities are lessened periodically and recreational activities (other than weightlifting) are pursued in short cycles. This important element, therefore, enables the body to recover physically and psychologically from intervals of increased training intensity.

Perhaps one of the greatest benefits of periodization is its co-promotion of the importance of both training and recuperation. Remember, the benefits of training don't just come from the training itself; the benefits are derived from a combination of both training and recuperation. The body must be allowed to heal, both physically and psychologically, in order for it to grow and strengthen. Most importantly, this scientifically validated approach helps to prevent the scourge of resistance training enthusiasts everywhere – overtraining. Overtraining is the decline in training performance typically attributable to an excessive training stimulus, usually the volume or intensity of the training.

The "Art" of Exercise Training

More precisely, the American College of Sports Medicine (ACSM) and the National Strength and Conditioning Association (NSCA) refer to this principle as the "art of exercise prescription." It is without question that effective resistance training is based on a firm foundation of scientific information. However, successful training regimens apply proven scientific principles to individuals in a flexible and adaptable manner. What works for Mr. Olympia or a world champion powerlifter is certainly not guaranteed to offer the same benefits for every serious health-fitness enthusiast. Instead, discriminating trainees should possess the ability to glean what training elements of other programs might work for them and which ones might not. Does this mean that successful strength trainees don't embrace what is effective for those elite persons on top of the iron world? Of course not, but intuitive training devotees understand how to incorporate those aspects of other programs which will work best for them. This may be accomplished by focusing upon perceived weak areas and incorporating new or different training techniques into one's personal program. Or, it may involve utilizing a variable training scheme where the frequencyvolume and intensity of training are modified to create a heightened training stimulus. In any case, informed strength trainees must recognize that some elements of various training programs will work for them and some will not. The recognition of which aspects of the program require alteration, the successful implementation of new training elements to one's program, and the identification of which proven methods should remain unchanged represent the essence of the "art" of exercise training.

These are a few of the concepts that have been incorporated into proven and successful training programs. This information should help individual's gain an appreciation for the important factors necessary for the achievement of training goals. A sound approach to such self-improvement should focus upon determining the purpose of the training, the customization of the training regimen to meet the individual's goals, and the optimization of individual training results. *Train hard, but train smart...*

Resistence Training

(Continued from page 3)

lift's range of motion, and the desired number of repetitions the lifter wants to perform. Using a spotter allows technique, range of motion, and balance to be maintained with a small amount of guidance rather than the lifter stressing muscles, ligaments, or tendons beyond their capability.

Other Considerations

Some practices are common to increasing weight room safety, regardless of lifter experience. All lifters should warm up sufficiently prior to any lifting exercises. Warm up exercises emphasizing the same muscles involved in the lifting program are often preferred. Lifters may have a certified personal trainer observe their technique. With practice, lifters can learn what joints to watch for unwanted motion or balance problems. Lifters may learn from watching good lifting techniques in others or by observing their own technique in weight room mirrors. Using a machine rather than free weights may be preferred at times, especially when the lift is new. It is possible to use poor technique or an improper range of motion on a machine, just as with free weights, but balance of the weight is generally not an issue. A good example is the flat dumbbell fly exercise. When performed with dumbbells, this exercise requires a great deal of balance and coordination to complete the lift with the proper range of motion. On a machine, however, the fly exercise will reduce the need for balance and allow lifts to be performed unilaterally (one arm at a time) more easily than dumbbells.

Other safety issues include weight belts, collars, and advanced lifts. Weight belts should be used on some lifts based on load and increased risk of lower back injury. Collars should be used on barbells to decrease the injury risk if weight balance is lost. More advanced lifts, such as power cleans, should be avoided until sufficient lifting experience and skill has been exhibited. Lifts such as this are complex and require much more sophisticated techniques than the typically performed weight-room lifts. Those performing resistance training programs will more quickly and safely attain the goals of their programs by following these guidelines for lifting technique, range of motion, and balance.

Women

(Continued from page 4)

for women, especially older women, in maintaining body weight as they get older. It is important to point out that little increase will be gained in muscle or energy expenditure unless intensity and effort are sufficient.

Although increases in muscle and strength occur quite easily during the first eight-16 weeks of training, continued increases are normally more difficult to achieve. The more "trained" an individual, the greater the training stimulus needs to be to create changes in strength and muscle size.

Maintaining a sufficient resistance and effort that will cause a muscle to fatigue in six-12 repetitions is important to achieve optimal progress. Although progress can be made in the early stages of training on only one set/exercise, both empirical and research data suggest continued improvement for the "trained" individual is not only dependent on maintaining a high relative resistance but on multiple sets. In other words, continued improvement is dependent on a combination of maintaining sufficient intensity/effort and volume of training.

Gains in strength, muscle size, ease of being physically active, and energy expenditure as well as fat losses occur with resistance training. However, it is important to maintain a relatively high intensity and effort in training to achieve these benefits.

Youth

(Continued from page 5)

understand the uniqueness of children and have a sound comprehension of strength training principles and safety guidelines (e.g., proper spotting procedures). The exercise environment should be safe and free of hazards and all participants should receive instruction regarding proper exercise technique (e.g., controlled movements) and training procedures (e.g., warm-up and cool-down periods). A medical examination is desirable, though not mandatory, for apparently healthy children who want to participate in a strength training program. However, a medical examination is recommended for children with known or suspected health problems.

A variety of training programs and many types of equipment — from rubber tubing to weight machines designed for children — have proven to be safe and effective. Although there are no scientific reports that define the optimal combinations of sets and repetitions for children and adolescents, one to three sets of six to fifteen repetitions performed two to three times per week on nonconsecutive days have been found to be reasonable. Beginning with one set of several upper and lower body exercises that focus on the major muscle groups will allow room for progress to be made. The program can be made more challenging by gradually increasing the weight or the number of sets and repetitions. Strength training with maximal weights is not recommended because of the potential for possible injuries related to the long bones, growth plates, and back. It must be underscored that the overriding emphasis should be on proper technique and safety, not on how much weight can be lifted.

Proper training guidelines, program variation and competent supervision will make strength training programs safe, effective and fun for children. Instructors should understand the physical and emotional uniqueness of children, and, in turn, children should appreciate the benefits and risks associated with strength training. If appropriate guidelines are followed, it is the opinion of ACSM that strength training can be enjoyable, beneficial and healthy experience for children and adolescents.

Supplementation

(Continued from page 7)

following a workout. A supplement taken in a liquid form will be absorbed at a quicker rate and should allow the nutrients to be used faster by the body. However, a quick meal will also provide similar benefits following a resistance-training workout. The most important thing is for athletes to consume nutrients immediately following a workout in order to obtain improved results from their training.

An athlete's nutritional intake plays a crucial role in the development of muscle size and strength in response to resistance training. A post-workout nutritional supplement can increase the amount of calories consumed during the day, thus contributing to a positive energy balance. It is also a method of providing the body with carbohydrates and protein when they are needed most. The provision of these nutrients will allow for quicker energy storage restoration, increase the amount of anabolic hormones in the body, and cut down on the amount of protein breakdown that occurs following resistance training.

Table 1. A summary of hormones and the their respective release site, target tissue, and principal effects.

Hormone	Release Site	Target Tissue	Principal Effects
Growth Hormone	Pituitary gland	Bone, cartilage, and skeletal muscle	Protein synthesis
Testosterone	Testicles and adrenal glands	Skeletal muscle	Protein synthesis
Insulin-like-growth factor I (IGF-I)	Liver	Bone, cartilage, and muscle	Protein synthesis
Insulin	Pancreas	Skeletal muscle	Stimulates absorption of carbohydrates and amino acids for energy production; protein synthesis(limits protein degradation)
Cortisol	Adrenal glands	Skeletal muscle	Protein degradation

Table 2. A summary of the general effects of post-workout supplementation

Post-workout Supplement	General Effects
Protein	increase protein synthesis increase amino acids in blood stream slightly increase insulin concentrations
Carbohydrate	quickly restores glycogen increase insulin concentrations decrease cortisol concentrations increased tissue absorption of testosterone increased growth hormone concentrations
Carbohydrate and Protein	increase protein synthesis increased amino acids in bloodstream quickly restores glycogen increase insulin concentrations decrease cortisol concentrations increased tissue absorption of testosterone increased growth hormone concentrations

"Fat Burners"

(Continued from page 9)

conversion of carbohydrates into fat. However, what happens in a petri dish is often quite different from what happens inside the human body. Moreover, it should be emphasized that the citrate lyase enzyme is only significantly activated when carbohydrate intake is considerably greater than carbohydrate requirements (i.e., exceeds storage capacity and utilization).

Animal studies appear to support HCAs efficacy as a fat burning supplement. Studies involving both lean and obese rats have shown that HCA can suppress appetite and reduce food intake leading to weight loss, decreased body fat and fat cell size, and reduced triglycerides. As is the case with most of the "fat burning" supplements, the efficacy of HCA supplementation for weight loss in humans is equivocal. Two early studies reported enhanced weight loss in subjects receiving 1000-2400 mg/d of HCA for four to eight weeks. However, in each study, HCA was accompanied by either a low-fat diet or another weight loss supplement (e.g., chromium, chitosan), rendering a valid determination of HCAs independent effect on weight loss impossible. A more recent study published in the *Journal of the American Medical Association* found that 1500 mg/d of HCA for 12 weeks did not augment weight loss in overweight men and women consuming a low calorie (approximately 1200 kcal/d), high fiber diet.

Is it safe?

No serious side effects have been reported with intakes of 1000 mg/d or less. As is the case with many of the fat burning supplements, high doses of HCA have been associated with gastrointestinal distress (e.g., abdominal bloating, gas, and diarrhea).

The Bottom Line

Although research in animals is promising, there is little solid scientific evidence to support the efficacy of HCA as a weight loss supplement for humans. Given HCA's supposed physiological role in macronutrient balance (i.e., reducing the conversion of excess carbohydrate to fat), it may be more effective as a weight maintenance supplement (i.e., preventing weight regain) rather than an anecdote for weight loss, which is best achieved via modifications in diet and physical activity.

Despite the marketing hype and deceptively credible claims, few of the popular "fat burning" supplements have actually been shown to be effective when held under scientific scrutiny. To date, there is no scientifically sound evidence to support the effectiveness of chromium picolinate, HCA, 7-keto-DHEA, or CLA for weight loss in humans. Pyruvate has been shown to be effective, but only at very high doses in morbidly obese women housed in a metabolic ward. Similarly, chitosan may inhibit fat absorption and promote weight loss, but only when combined with a low-calorie, low-fat diet. In fact, the only "fat burner" that has been shown to be unequivocally effective is ephedrine; however, given its potentially life-threatening side effects, it should not be considered a viable option. Thus, there is really only one safe and reliable way to increase your fat burning capability: exercise!

Winter Sports

(Continued from page 10)

intervals at first and then gradually progress to 10 intervals. As your fitness improves, progressively lengthen the intervals to one minute and use a one-to-two work/rest ratio.

For aerobic sports, interval training once a week also improves performance. These intervals, however, can be done on a three to three work/rest ratio or even a five-to-10 minute work interval followed by one-to-two minutes of recovery. The intensity of these intervals is not as high and only three-to-five intervals are recommended. Your interval-training workouts are not performed in addition to the regular aerobic workouts, but take the place of one of these workouts.

There are sport-specific strength requirements as well. Look at the primary muscles used in your sport and make sure your choice of exercises works these muscles. Try to perform your strength training through a similar range of motion as used in your sport. Aerobic/anaerobic sports require greater strength, thus three sets of eight to 12 repetitions to near fatigue are recommended two to three times per week. For aerobic sports, a minimum of one set of eight to 12 repetitions to near fatigue performed one or two times per week is recommended.

In alpine skiing and snowboarding, gravity supplies most of the propulsion and the body acts more as a shock absorber. Muscles in the hips, knees, and trunk are used to control the forces on the body and equipment. Multi-joint exercises like leg presses, squats, and lunges are important choices for these activities.

Before the season starts, make sure your equipment is in proper working condition. For example, alpine skiers' bindings should be cleaned and adjusted properly so they will release as needed. This is one of the most important things you can do to help prevent knee injuries. A good pair of bindings is cheaper than knee surgery. The first few times out, go easy, practice technique, and do not continue once fatigued. Gradually increase the length and intensity of your workouts. Consider taking a lesson to have someone watch your technique and help correct flaws early in the season. Even Olympic athletes have coaches watch them.

Enjoy a long and healthy winter season!

Sports Nutrition

(Continued from page 11)

drinks, the player's cramping problem dissipated.

Dr. Martin Schwellnus of the University of Cape Town Medical School in South Africa offers another theory, based on science rather than anecdotes. He believes cramps occur when the muscles are fatigued. A nerve malfunction creates an imbalance between muscle excitation and inhibition; the muscle doesn't relax. His solution: stretch the cramp.

Overhydration

In an effort to prevent muscle cramps and dehydration, some endurance athletes drink copious amounts of fluids, so much so they dilute their blood to the point sodium levels are dangerously low. This often occurs in slower marathoners who take the advice to drink at every water station. Excess water, in combination with a low salt diet, increases the risk of suffering from hyponatremia (low blood sodium); the athlete becomes tired, nauseated, disoriented or even worse, may suffer a seizure. The solution: Don't avoid salt and don't drink if your stomach is sloshing!

Exercise and weight loss

The myth is you'll lose body fat by adding exercise. The truth is you'll lose body fat if you create a calorie deficit. In a study with previously sedentary overweight males and females (average ages 22-24 years) who exercised five times a week for 16 months with no dietary restrictions, the men lost 12 lb. (body fat dropped 27 to 22 percent); they failed to eat enough to compensate for the extra calories burned. The women, however, had no significant weight or body fat changes; their appetites kept up with their calorie expenditure. In a study with 220 women (ages 35-45), changes in calorie intake (i.e., eating less food) were more closely related to changes in body fatness than were changes in exercise. This means remember to subtract food, not just add exercise!