Innovative Methods to Optimize Power Production and Body Weight Reduction

***Hashem A. Kilani, **Maher Alkilani, & *Majed AlBusafi**
***Sultan Qaboos University**
College of Education
Physical Education Department
Hashemite University, Zarqa, Jordan
hakilani@yahoo.com

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INTRODUCTION:

Muscles generate force in slow or fast rate depending on many factors. One factor is the increasing size of the cross sectional area of muscle's bulk and corresponding mass. Another factor is the stretch reflex mechanism and related elastic energy storage in the muscle (Kilani, Palmer, & Gapsis, 1989). Based on Newton's Second Law, the more force a muscle produces, the greater the acceleration of its segments; while, the more mass a muscle has, the lower the acceleration of its segments. However, in jumping and other events, athletes need to combine a greater rapid force generation and a conserved or reduced body weight (Kilani, 2000). In vertical jumps, two components contribute to the power output: the amount of optimum impulse generated at take off and type of muscle contraction with related mass. So it is assumed that having more leg muscle mass would be associated with a better utilization of elastic component in the muscle and achievement of a higher jump height (Kilani et al., 1989). Muscle strength can be defined as the maximum force generation capacity (Macaluso and De Vito 2004). The neural factors regulate muscle force generation. Increased levels of muscle activation and consequent increase in muscular force are achieved by increases in the firing rate of each motor unit,changes in the pattern of motor unit activation and the recruitment of more motor units (Komi 1986, Häkkinen1994a, Barry and Carson 2004, Kamen 2005).

It has been well known that systematic resistance training, especially among initially untrained healthy subjects, has a potent effect in promoting increases in size and strength of skeletal muscle. This is true both in men and women. Although women have lower absolute strength than men, the relative increases in strength following a training programme are similar between genders, at least in the beginning of resistance training (Häkkinen and Pakarinen 1994, Staron et al. 1994, Häkkinen et al. 2000a).

Maximal muscle power output and the potential for explosive movement is determined mainly by the proportion of fast twitch fibers. For example, weightlifters and sprinters who must do more explosive movements have a considerably higher proportion of fast twitch fibers than bodybuilders, powerlifters, and endurance athletes. High intensity is not necessarily dependent upon the use of near-maximal or maximal loads but more to the degree to which the relevant muscle fibers are recruited during the effort. The terms “fast twitch” and “slow twitch” do not necessarily mean that fast movements recruit

exclusively fast twitch fibers and slow movements recruit exclusively slow twitch fibers. The fibers involved are determined by the force that is produced.
For example, the maximum force generated during rapid acceleration of a 220-pound bench press can easily exceed the maximum force produced during a slowly accelerated 330-pound bench press. Small loads accelerated rapidly and heavy loads accelerated slowly both involve fast twitch fibers. However, the explosive movements rely heavily on the action of the fast twitch fibers. Also, accelerated movements recruit the muscle stretch (myotatic) reflex, which can elicit a faster and more powerful contraction. The pre-stretch principle is well known in sports and in the plyometric method in explosive training.
Training the fast twitch fibers also includes the storage and release of elastic energy by the connective tissues in the muscle/tendon complex and should not be ignored by bodybuilders, powerlifters, power athletes, and endurance athletes. This is done by involving the stretch reflex, which entails accumulation of energy in the muscle-tendon complex prior to a quick explosive contraction and accelerates the weight or object held. After this, the weight or object moves on its own momentum followed by some muscle involvement until the movement stops.
After approximately seven weeks of training based on applying the principle of stretch reflex training, Phil Murphy, a former lineman for the then Los Angeles Rams football team in the early 80s, lost 25 pounds of mostly fat and posted 255 pounds of lean muscle mass at a weight of 325.(Michael Yessis,2008)
The use of vibration as a means for enhancing athletic performance is a recent issue in exercise physiology. Current evidence suggests that vibration is effective in enhancing strength and the power capacity of humans with decreasing weight, relying on the stretch reflex utilization. (Cardinale, and Bosco, 2003, Kilani,2000, kilani2010, Kilani & Abu Eisheh, 2010). The purpose of this paper is to address this dilemma by shedding light on the innovative findings regarding the variables that are related to power production and body weight reduction. The interplay among aerobics, anaerobic exercises, intensity level, resistance training, reflex contribution, and nutrition will be examined. This review will support those patients who are not able to lose weight and gain strength in short time.

BACK GROUND:
It is known, nearly three fourths of the UAE’s population is battling with obesity – which has been termed as a silent killer by the World Health Organization (WHO) (MOH/UAE,2003). It is also known that nine out of 10 cases of obesity develop into diabetic cases. Obesity is clearly becoming an epidemic which needs urgent attention (Mokdad et al 1999). Some of the health problems associated with obesity include Type 2 diabetes, heart disease, cancer, stroke, back and joint pain, osteoarthritis, high blood pressure, gallstones, fatty liver, infertility, breathlessness, depression, snoring, difficulty in sleeping and excessive sweating. (Alhazza and Musaiger, 2010), (Physical activity and health Report, 1996; National Task Force on the Prevention and Treatment of Obesity, 2000)
An estimated 97 million adults in the United States, or more than six out of 10 men and women, are overweight or obese.(Mokdad et al 1999). In the United

States alone, approximately 300,000 deaths each year are attributed to a combination of dietary factors and physical inactivity—the two primary culprits of obesity—making these lifestyle habits second only to cigarette smoking as the leading cause of death in the United States.(McGinnis and, Foege, 1993) The trend of overweight and obesity in adults appears to be growing unabated, while an increase in the number of overweight American youths points to an even greater preponderance of adult obesity and its associated co-morbidities in the future.(MMWR,1994)

Not many are aware that obesity not only affects the adults but also children, who incidentally are even more vulnerable, primarily because of the likelihood of growing up to become obese adults. Studies indicate that obesity is more likely to persist when its onset is in late childhood or adolescence and where children have obese parents. Problems associated with excess weight in children and adolescence includes heat intolerance, breathlessness on exertion, tiredness, and flat feet. (LeMURA and MAZIEKAS,2002, Kilani,2005, Alhazza,1996)

No longer is there any serious doubt about the strong impact of physical activity on promoting health and preventing disease, or achieving and maintaining a healthy body weight. Despite the well-known benefits of regular physical activity, only about 15 percent of American adults regularly engage in the modest amount of activity required to obtain health benefits, while more than one fourth of adults are sedentary

The potential medical hazards of obesity have been documented extensively.(Pi-Sunyer ,1993, NTFPTO,2000). According to the American Heart Association (AHA), obesity is a major independent risk factor for coronary heart disease (CHD), and it appears to interact with or amplify the effects of other cardiovascular risk factors, including hypertension, dyslipidemia, insulin resistance, and hyperinsulinemia.(Eckel and, Krauss, 1998) Moreover, clustering of risk factors in obesity is important because obese persons face more than a 65 percent chance of having at least one additional risk factor for CHD,(Yusuf, Giles, Croft, Anda, and Casper, 1998) and a 50 percent chance of having two or more other risk factors for heart disease.(Wilson, Kannel, Silbershatz, and D'Agostino,1999)

The World Health Organization (WHO) Eastern Mediterranean Region is exposed to NCD risk factors as part of risk- transition as a result of marked changes in the pattern of living in many countries of the Region, particularly countries of the Gulf Cooperation Council, where rapid increases in obesity are being recorded, primarily among children, adolescents and young adults. Overweight and obesity have risen 2-fold or more since 1980. Changes in food processing, production and type of food (fast food) have affected health in the majority of countries in the Region.

The prevalence of overweight and obesity for males and females in a number of countries of the Region among males, ranges from 10.5% in Pakistan to 64.0% in Saudi Arabia, while for females it ranges from 21.7% in Morocco to 79.0% in Bahrain (Wee, McCarthy, Davis, and Phillips, 1999). The regional adjusted mean for overweight and obesity is 54.2% for women compared to 31.4% among males. Obesity kills around 150 000 men and women a year in the Region.

According to the World Health Organization, the most important risk factors of non-communicable diseases in the Arab countries included high blood pressure, high concentrations of cholesterol in the blood, inadequate intake of fruit and vegetables, overweight or obesity, physical inactivity and tobacco use. Five of these risks are closely related to improper diet and physical inactivity (Hazzaa et al,2010)

Because studies have demonstrated that obesity in childhood tracks into adulthood, public health officials commonly refer to pediatric obesity as an “alarming trend” and as an “epidemic” research synthesis demonstrated the effectiveness of exercise as an adjunctive treatment for childhood and adolescent obesity. With regard to the development of an appropriate exercise prescription, the most favorable alterations in body composition were associated with low-intensity, long-duration exercise and aerobic exercise combined with high-repetition resistance training. (LeMura, and Maziekas, 2002)

The 1998 NIH Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults Report indicates that more research is needed on effects on body weight/obesity of different lengths of physical activity interventions, different formats and intensities of physical activity, and different forms of physical activity in combination with diet, as well as effects of physical activity on body fat distribution, e.g., abdominal fat. The recommendations of this report for future research includes the need to determine the optimal amount of physical activity to promote weight loss, maintenance of weight loss, and prevention of obesity, as well as strategies to preserve muscle and bone in the face of weight loss.

Research is needed on the effects of pharmacologic intervention for weight loss on cardiorespiratory fitness. Research is also needed on environmental and population-based intervention methods for weight control that incorporate physical activity. These studies should address high-risk populations for obesity and low levels of physical activity including underserved population segments, e.g., minorities and low socioeconomic (SES) groups.

Education about the long-term health consequences and risks associated with overweight and how to achieve and maintain a preferred weight is necessary. While many individuals attempt to lose weight, studies show that within five years a majority of them regain the weight. In order to maintain weight loss, good dietary habits must be coupled with increased physical activity, and these must become permanent lifestyle changes. It is still not clear, however, which behavioral approaches are best for achieving these changes, particularly long-term. A 1998 NHLBI workshop on Maintenance of Behavior Change in Cardiorespiratory

Risk Reduction concluded that additional research is needed to examine factors associated with long-term maintenance of weight loss, long-term maintenance of increased physical activity levels, and the relationship between the two. In

addition, the question of whether physical activity enhances long-term maintenance of weight loss has not been formally examined
The following are examples of research topics and study approaches that are relevant. Applicants are encouraged to consider these questions, when relevant, in relation to persons with and without morbid conditions (such as hypertension, diabetes, arthritis). Likewise, applicants are encouraged to provide a rationale for the type of physical activity (e.g., aerobic, anaerobic, resistance) that they propose in their applications.

METABOLISM:
The speed of basal metabolic energy depends primarily on body composition. Research shows that the leaner muscle mass, the faster the metabolism. Another factor affecting energy expenditure is something called "dietary induced thermogenesis" (digesting, transporting and storing food). This is the least significant in terms of calories, and accounts for about 10 percent of total calories expended (about 75 to 200 calories burned per day). The third factor is activity, which accounts for approximately 15 to 35 percent of total calorie burning. Any activity we engage in, whether it's running, walking or fidgeting burns calories above and beyond our BMR. (Berhm, 2008)

Some people have a higher metabolism than others, which can vary as much as 30 percent. More emphasis is being placed on the percentage of muscle and fat, and less on total body weight. Dieting shuts off metabolism and causes a loss of lean muscle mass. For every diet, there is an equal and opposite binge. Statistics show that people gain back more weight after dieting, and with a higher percentage of body fat. These are abysmal statistics. Evans, (2001), states, "By cutting back in calories, you will see an immediate drop in metabolic rate."
Sports nutrition is built upon an understanding of how nutrients such as carbohydrate, fat, and protein contribute to the fuel supply needed by the body to perform exercise. These nutrients get converted to energy in the form of adenosine triphosphate or ATP. It is from the energy released by the breakdown of ATP that allows muscle cells to contract. However, each nutrient has unique properties that determine how it gets converted to ATP.
Carbohydrate is the main nutrient that fuels exercise of a moderate to high intensity, while fat can fuel low intensity exercise for long periods of time. Proteins are generally used to maintain and repair body tissues, and are not normally used to power muscle activity.

ENERGY PATHWAYS:
Because the body cannot easily store ATP (and what is stored gets used up within a few seconds), it is necessary to continually create ATP during exercise. In general, the two major ways the body converts nutrients to energy are:
Aerobic metabolism (with oxygen)
Anaerobic metabolism (without oxygen)

These two pathways can be further divided. Most often it's a combination of energy systems that supply the fuel needed for exercise, with the intensity and duration of the exercise determining which method gets used when.
ATP-CP Anaerobic Energy Pathway
The ATP-CP energy pathway (sometimes called the phosphate system) supplies about 10 seconds worth of energy and is used for short bursts of exercise such as a 100 meter sprint. This pathway doesn't require any oxygen to create ATP. It first uses up any ATP stored in the muscle (about 2-3 seconds worth) and then it uses creatine phosphate (CP) to resynthesize ATP until the CP runs out (another 6-8 seconds). After the ATP and CP are used the body will move on to either aerobic or anaerobic metabolism (glycolysis) to continue to create ATP to fuel exercise.

Anaerobic Metabolism - Glycolysis
The anaerobic energy pathway, or glycolysis, creates ATP exclusively from carbohydrates, with lactic acid being a by-product. Anaerobic glycolysis provides energy by the (partial) breakdown of glucose without the need for oxygen. Anaerobic metabolism produces energy for short, high-intensity bursts of activity lasting no more than several minutes before the lactic acid build-up reaches a threshold known as the lactate threshold and muscle pain, burning and fatigue make it difficult to maintain such intensity.
Aerobic Metabolism
Aerobic metabolism fuels most of the energy needed for long duration activity. It uses oxygen to convert nutrients (carbohydrates, fats, and protein) to ATP. This system is a bit slower than the anaerobic systems because it relies on the circulatory system to transport oxygen to the working muscles before it creates ATP. Aerobic metabolism is used primarily during endurance exercise, which is generally less intense and can continue for long periods of time.
During exercise an athlete will move through these metabolic pathways. As exercise begins, ATP is produced via anaerobic metabolism. With an increase in breathing and heart rate, there is more oxygen available and aerobic metabolism begins and continues until the lactate threshold is reached. If this level is surpassed, the body cannot deliver oxygen quickly enough to generate ATP and anaerobic metabolism kicks in again. Since this system is short-lived and lactic acid levels rise, the intensity cannot be sustained and the athlete will need to decrease intensity to remove lactic acid build-up.

FUELING THE ENERGY SYSTEMS
Nutrients get converted to ATP based upon the intensity and duration of activity, with carbohydrate as the main nutrient fueling exercise of a moderate to high intensity, and fat providing energy during exercise that occurs at a lower intensity. Fat is a great fuel for endurance events, but it is simply not adequate for high intensity exercise such as sprints or intervals. If exercising at a low intensity (or below 50 percent of max heart rate), you have enough stored fat to fuel activity for hours or even days as long as there is sufficient oxygen to allow fat metabolism to occur.

As exercise intensity increases, carbohydrate metabolism takes over. It is more efficient than fat metabolism, but has limited energy stores. This stored carbohydrate (glycogen) can fuel about 2 hours of moderate to high level exercise. After that, glycogen depletion occurs (stored carbohydrates are used up) and if that fuel isn't replaced athletes may hit the wall or "bonk." An athlete can continue moderate to high intensity exercise for longer simply replenishing carbohydrate stores during exercise. This is why it is critical to eat easily digestible carbohydrates during moderate exercise that lasts more than a few hours. If you don't take in enough carbohydrates, you will be forced to reduce your intensity and tap back into fat metabolism to fuel activity.
As exercise intensity increases, carbohydrate metabolism efficiency drops off dramatically and anaerobic metabolism takes over. This is because your body can not take in and distribute oxygen quickly enough to use either fat or carbohydrate metabolism easily. In fact, carbohydrates can produce nearly 20 times more energy (in the form of ATP) per gram when metabolized in the presence of adequate oxygen than when generated in the oxygen-starved, anaerobic environment that occurs during intense efforts (sprinting).
With appropriate training, these energy systems adapt and become more efficient and allow greater exercise duration at higher intensity.
Fat needs oxygen to burn completely so in order to burn fat during an exercise we need to move slowly and smoothly. This enables muscle cells to be supplied with enough oxygen to continue with its aerobic capacity and utilize fat as the main energy source.
Anaerobic exercise requires moving at an increased pace or with greater effort. Exercising this way burns more calories but results in a greater demand for oxygen which cannot be delivered in sufficient quantities to allow cells to continue burning fat. When we breath heavy we start to develop an oxygen debt and muscle cells switch to burning mainly carbohydrates, this fuel burns quickly and does not require oxygen.
Anaerobic exercises such as sprinting or weight training require more effort and up to 95% of the fuel used will be carbohydrates.
Most people assume running is an aerobic exercise, and if done at a certain intensity level it will still require oxygen, therefore remaining an aerobic exercise. But as the intensity level increases, and the body cannot supply sufficient oxygen, it will switch to using a higher percent of carbs and a lower percent of fat for fuel.

Exercise to Burn Fat:
while doing aerobic exercises, your body uses a higher percent of fat for fuel. Approximately 60% of the total calories burned during a low to moderate aerobic exercise are from fat. As the intensity level increases, the body switches from using fat as the primary source of fuel to using readily available carbohydrates. At a high intense aerobic workout, you will use only approximately 35% of fat for fuel. At an extreme or vigorous workout level, or an anaerobic exercise, the percent of fat may only be 5% of total calories burned during exercise as your muscles do not require oxygen.

Based on this most people assume that the low to moderate intense level gives you the most fat calories burned, however, it is all relative to the total calories burned during exercise. The low intense level aerobic exercises, while burning a higher percent of fat, will actually produce the lowest number of total calories burned. While the higher intense aerobic workouts give a lower percent of fat burn, it also gives you the higher calories burned.

A new study has shown that walking speed over 6 m in older people is predictive of cardiovascular mortality, with those in the lowest tertile three times more likely to suffer CV death over five years than those who walked faster. Walking is one of the favorite activity pastimes of older adults, but few of them might consider that increasing their speed and agility may prevent hospitalization or disability. However, a study by Cesari and colleagues, which was published in the October 2005 issue of the Journal of the American Geriatric Society, demonstrated that walking speed translates into important clinical outcomes. Among 3047 older adults, those with a walking speed of less than 1 meter per second were more likely to have a hospitalization or lower extremity disability vs older adults with a faster walking speed.

The Cesari study also suggested that participants with a slower walking speed also experienced an increased risk for death. The current study further investigates this issue.

Doing aerobics isn't a smart way to exercise, and it doesn't build your lungs or breathing capacity as the name implies. In fact, aerobics actually shrinks your heart and lungs - making you more vulnerable to fatal heart attacks.

(Alsears,2010)

Izumi Tabata (1996) showed that moderate-intensity aerobic training that improves the maximal aerobic power does not change anaerobic capacity and that adequate high-intensity intermittent training may improve both anaerobic and aerobic energy supplying systems significantly, probably through imposing intensive stimuli on both systems.

Interestingly, the high-intensity protocol had been used by major members of the Japanese Speed Skating team for several years; it's a real-world training plan. As you will see, however, the protocol is unique among aerobic training programs for its intensity and brevity.

Many studies have been done on the effect of training on V02max, but little information has been available about the effect on anaerobic capacity. That's because until recently methods for measuring anaerobic capacity have been inadequate. This study used accumulated oxygen deficit to measure anaerobic energy release, and is one of the first to measure the effect of training on both aerobic and anaerobic capacity.

Notice that the duration of the moderate-intensity and the high-intensity protocols are drastically different: (excluding warm-ups) one hour compared to only about 4 minutes per training schedule

Tabata's moderate-intensity protocol will sound familiar; it's the same steady-state aerobic training done by many (perhaps most) fitness enthusiasts. In the moderate-intensity group, seven active young male physical education majors exercised on stationary bicycles 5 days per week for 6 weeks at 70% of V02max, 60 minutes each session. V02max was measured before and after the training and every week during the 6 week period. As each subject's V02max improved, exercise intensity was increased to keep them pedaling at 70% of their actual V02max. Maximal accumulated oxygen deficit was also measured, before, at 4 weeks and after the training.

A second group followed a high-intensity interval program. Seven students, also young and physically active, exercised five days per week using a training program similar to the Japanese speed skaters. After a 10-minute warm-up, the subjects did seven to eight sets of 20 seconds at 170% of V02max, with a 10 second rest between each bout. Pedaling speed was 90-rpm and sets were terminated when rpms dropped below 85. When subjects could complete more than 9 sets, exercise intensity was increased by 11 watts. The training protocol was altered one day per week. On that day, the students exercised for 30 minutes at 70% of V02max before doing 4 sets of 20 second intervals at 170% of V02max. This latter session was not continued to exhaustion. Again, V02max and anaerobic capacity was determined before, during and after the training.

In some respects the results were no surprise, but in others they may be ground breaking. The moderate-intensity endurance training program produced a significant increase in V02max (about 10%), but had no effect on anaerobic capacity. The high-intensity intermittent protocol improved V02max by about 14%; anaerobic capacity increased by a whopping 28%.

It was the first study to demonstrate an increase in both aerobic and anaerobic power.

The results, of course, confirm the well-known fact that the results of training are specific. The intensity in the first protocol (70% of V02max) did not stress anaerobic components (lactate production and oxygen debt) and, therefore, it was predictable that anaerobic capacity would be unchanged. On the other hand, the subjects in the high-intensity group exercised to exhaustion, and peak blood lactate levels indicated that anaerobic metabolism was being taxed to the max. So, it was probably also no big surprise that anaerobic capacity increased quite significantly.

What probably was a surprise, however, is that a 4 minute training program of very-hard 20 second repeats, in the words of the researchers, "may be optimal with respect to improving both the aerobic and the anaerobic energy release systems." That's something to write home about!

High-intensity Interval Training:

This commentary highlights recent work from Dr. Gibala's laboratory examining rapid adaptations in exercise capacity and aerobic energy metabolism after short-term HIT. Using the Wingate Test, he explores the effect of HIT on exercise capacity, skeletal muscle adaptations to HIT, compares it with traditional endurance training.(Gibala, , 2007)

Tremblay, A. et al., (1994), had participants spilt into 2 groups: one group doing 20 weeks of steady state aerobics and the other group did 15 weeks of HIIT (High Intensity Interval Training). The second group exercised for 5 less weeks

and expended 48% less calories per exercise bout, but nevertheless burned 900% more fat than the first group. It was concluded that compared to moderate-intensity endurance exercise, high- intensity intermittent exercise causes more calories and fat to be burned following the workout.
Similar metabolic adaptations during exercise after low volume sprint interval and traditional endurance training in humans. Kirsten A. Burgomaster, Howarth, Phillips, Rakobowchuk, MacDonald, McGee and Gibala,(2008) reported that 6 weeks of low-volume, high-intensity sprint training induced similar changes in selected whole-body and skeletal muscle adaptations as traditional high-volume, low-intensity endurance workouts undertaken for the same intervention period.
Hawley,(2008) stressed that the key components of any training programme are the volume (how much), intensity (how hard) and frequency (how often) of exercise sessions. These ‘training impulses’ determine the magnitude of adaptive responses that either enhance (fitness) or decrease (fatigue) exercise capacity (Hawley, 2002).
One of the key tenants of exercise physiology is the principle of training specificity, which holds that training responses/adaptations are tightly coupled to the mode, frequency and duration of exercise performed. This means that the vast majority of training-induced adaptations occur only in those muscle fibres that have been recruited during the exercise regimen, with little or no adaptive changes occurring in untrained musculature. Furthermore, the principle of specificity predicts that the closer the training routine is to the requirements of the desired outcome (i.e. a specific exercise task or performance criteria), the better will be the outcome. However, the Burgomaster et al. (2007) reported that 6 weeks of low-volume, high-intensity sprint training induced similar changes in selected whole-body and skeletal muscle adaptations as traditional high-volume, low-intensity endurance workouts undertaken for the same intervention period. Specifically, they show that four to six 30 s sprints separated by 4–5 min of passive recovery undertaken 3 days per week results in comparable increases in markers of skeletal muscle carbohydrate metabolism (i.e. total protein content of pyruvate dehydrogenase), lipid oxidation (i.e. maximal activity of β-3-hydroxyacyl CoA dehydrogenase) and mitochondrial biogenesis (i.e. maximal activity of citrate synthase and total protein content of the peroxisome-proliferator-activated receptor-γ coactivator-1α) as when subjects undertook 40–60 min of continuous submaximal cycling a day for 5 days per week. These findings are particularly impressive given that weekly training volume was ~90% lower in the sprint-trained group (~225 versus 2250 kJ $week^{-1}$) resulting in a total cumulative training time of ~1.5 versus 4.5 h per week.

What About Fat Loss?
Tremblay, et al 1994, challenged the common belief among health professionals that low-intensity, long-duration exercise is the best program for fat loss. They compared the impact of moderate-intensity aerobic exercise and high-intensity aerobics on fat loss. They divided 27 inactive, healthy, non-obese adults (13 men, 14 women, 18 to 32 years old) into two groups. They subjected one group to a 20-week endurance training (ET) program of uninterrupted cycling 4 or 5

times a week for 30 to 45 minutes; the intensity level began at 60% of heart rate reserve and progressed to 85%. (For a 30-year-old, this would mean starting at a heart rate of about 136 and progressing to roughly 170 bpm, which is more intense than usually prescribed for weight or fat loss.)

The other group did a 15-week program including mainly high-intensity-interval training (HIIT). Much like the ET group, they began with 30-minute sessions of continuous exercise at 70% of maximum heart rate reserve (remember, they were not accustomed to exercise), but soon progressed to 10 to 15 bouts of short (15 seconds progressing to 30 seconds) or 4 to 5 long (60 seconds progressing to 90 seconds) intervals separated by recovery periods allowing heart rate to return to 120-130 beats per minute. The intensity of the short intervals was initially fixed at 60% of the maximal work output in 10 seconds, and that of the long bouts corresponded to 70% of the individual maximum work output in 90 seconds. Intensity on both was increased 5% every three weeks.The total energy cost of the ET program was substantially greater than the HIIT program. The researchers calculated that the ET group burned more than twice as many calories while exercising than the HIIT program. But (surprise, surprise) skinfold measurement showed that the HIIT group lost more subcutaneous fat.

"Moreover," reported the researchers, "when the difference in the total energy cost of the program was taken into account..., the subcutaneous fat loss was ninefold greater in the HIIT program than in the ET program." In short, the HIIT group got 9 times more fat-loss benefit for every calorie burned exercising.

In order to determine why high-intensity exercise produce so much more fat loss, Tremply et al, (1994), took muscle biopsies and measured muscle enzyme activity. "[Metabolic adaptations resulting from HIIT] may lead to a better lipid utilization in the postexercise state and thus contribute to a greater energy and lipid deficit." In other words, compared to moderate-intensity endurance exercise, high- intensity intermittent exercise causes more calories and fat to be burned following the workout. Citing animal studies, they also said it may be that appetite is suppressed more following intense intervals. (Neither group was placed on a diet.)

It's always better to underestimate your ability at the start. Begin a little slower than you think you can handle, and then adjust the pace from workout to workout. Don't attempt high-intensity intervals unless you are in good condition; they're not appropriate for beginners

Strength Training

Strength training is considered an anaerobic exercise regardless of how heavy the resistance or how many repetitions. Strength training is all about challenging the muscles through resistance in order to tone and strengthen. Strength training is not considered a fat burning exercise while performing the exercise. However, it will bring you fat burning benefits. This is done by increasing your lean muscle mass and the more lean muscles you have, the higher your basal metabolic rate. There was a landmark study done some years back by Dr. James Rippe that really punctuates the benefits of anaerobic exercise verses aerobic exercise, or no exercise at all.

Dr. Rippe took 65 people and divided them into three groups. Each of them was put on the same diet. They simply ate fewer calories than they normally would, assuring that they would all lose some weight. They participated in this study for six weeks.
Group one did no exercise at all during the six weeks, group two did only aerobic exercise, and group three did only anaerobic exercise.
Here are the results..
Weight loss: Group one (no exercise) lost 9 pounds. Group two (aerobic exercise) lost 10 pounds, and group 3 (anaerobic exercise) lost 9 pounds.
So far things are very even. But here's where it gets really interesting.
Muscle loss: Group one (no exercise) lost 11% of their muscle mass. Group two (aerobic exercise) lost 1% of their muscle mass, and group 3 (anaerobic exercise) lost no muscle mass.
Notice that even those who did aerobic exercise lost muscle mass!
Muscle gain: In the final category, only those who did anaerobic exercise gained muscle mass−9%.
Everyone lost weight, but it was only the strength trainer's who added calorie-burning muscle while losing fat.

In summary:
The intensity of anaerobic exercise stimulates an increased demand for calories and an elevated body temperature. These factors generate an increase in your metabolic rate (the rate at which you burn calories) that lasts for several hours after your workout.
Since your preferred fuel choice at rest is fat, you will burn fatter around the clock because of your glucose-burning workout! However wonderful this sounds, many exercisers take shortcuts that sabotage the weight loss benefits of high intensity workouts.

The round-the-clock increase in metabolism caused by an effective training program is the only true way to lose weight. Consider that during a vigorous hour of exercise, you burn between 500-800 calories. A tall glass of orange juice and a bran muffin get you nearly back to even.
The Aerobic Base Building is first then only will the dramatic benefits of high-intensity training be enjoyed.

Research has shown that people who exercise regularly have far more fat-burning enzymes in their muscles than people who don't exercise.
Exercise positively affects a number of hormones in your body which are related to fat storage such as insulin, adrenaline, and cortisol. Endorphins, small morphine-like chemicals, are secreted with exercise and can also help reduce fat storage, as well as create a feeling of well-being and alleviate stress. Exercise also accelerates food transit time through the intestines to complete the digestive cycle. This reduces the chances for digestive disorders and bowel cancer. The more you do, the more you will want to do as the benefits continue to increase

and you get the results you're after. In short, exercise is a must for losing body fat as well as improving the overall quality of life. It will add years to your life and life to your years

The mission of America's Fitness Coach® is to improve the health of every American and lower the cost of healthcare, by teaching and motivating everyone to take better care of their most valuable asset − their body; so that, everyone can enjoy all that life has to offer by actively participating in the blessings of physical activity.
With compassionate understanding; humorous true life stories; the latest science on exercise physiology and nutrition; and relentless motivational conviction toward personal responsibility; Dave Hubbard's goal is to help everyone overcome every obstacle and excuse to getting and staying healthy and physically fit for life.
Dave's formula has remained the same for over 20-years; Education + Motivation x Application = Results. He believes this formula is absolutely essential for anyone wanting to develop a new habit they intend to continue for the rest of their life.

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