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Progressive Resistance Training (PRT) and Health

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Your Life Your Health

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I have always had a prejudice against weight lifting. Rather than admiring the be-muscled physique of the grossly-muscled, bar-bell addict, for years, I let my prejudice blind me to the benefit of appropriate resistance training, either lifting free weights or using resistance machines. My interest in the benefit of muscle conditioning was reinforced this February when a leading diabetes journal, *Diabetes Care*, published a study entitled, “Twice-Weekly Progressive Resistance Training Decreases Abdominal Fat and Improves Insulin Sensitivity in Older Men With Type 2 Diabetes.”

The American College of Sports Medicine defines PRT as “training in which the resistance against which a muscle generates force is progressively increased over time.” This is really a technical way of saying, “PRT is training in which muscles are strengthened by challenging them with heavier and heavier weights.” The goal of PRT is not to build big muscles, but to improve the function of the muscles we have. Sometimes, we call this “toning” the muscles. The muscle size is not increased in this process but the functional capacity of the muscle is increased.

Application For Everyone

You may say, but I don’t have diabetes, why should I be interested? The first reason is that this study has implications for everyone. Anyone will benefit, in many ways, from strengthening their muscles and maintaining the flexibility and stability of their joints; all of these are improved by PRT. The second is that everyone who is over 60 has a decline in insulin sensitivity due to decreased physical activity and increased fat around the abdomen. Whether you are diabetic, pre-diabetic or simply at risk for diabetes – and those three groups include almost everyone over 50 years of age – PRT will improve your health.

Third, more people are at risk of developing type 2 diabetes than imagine that they are. That is why we assess everyone who comes to SETMA for their potential risk of developing diabetes. And, it is why we screen everyone who is at risk for the pre-diabetes conditions of impaired fasting glucose and impaired glucose tolerance. Fourth, the best way to treat diabetes is: don’t get it. Those with type 1 diabetes didn’t do anything to get it and need excellent, aggressive treatment. Those at risk of type 2 diabetes can often avoid it and those who have type 2 diabetes can sometimes reverse the process with aggressive measures, even after it has developed.

The Design of the Above-Mentioned Study

1. Nine older men whose ages ranged from 61.5 years to 69.7 years, each of whom had type 2 diabetes, participated in a 16-week progressive resistance training (PRT) supervised program.
2. These men had their maximum weight lifting capacity determined and then were exercised at 50-80% of that weight in all of the major muscle groups of the upper and the lower extremities. This means that if a person could lift 30 pounds, he would do repetitions to fatigue with 15-24 pounds.
3. This was done in a supervised setting so as to minimize the danger of injury and to document the accuracy of the lifting.

Each patient had the following measurements done:

1. Basal blood sugar
2. HbA_{1c} -- a measure of the average blood sugar over the past 90 days which is used to evaluate the effectiveness of the care of diabetics
3. Diet
4. Habitual physical activity
5. Body composition which is height, weight, body mass index (BMI)
6. Upper/lower maximal strengths were measured.
7. Insulin sensitivity – this is a measurement of how a person's liver, muscle and other body tissues respond to insulin
8. Body Fat Percent

These measurements were taken four weeks before training, at the beginning of training and at 8 and 16 weeks of training. The result of the strength training was as follows:

1. No significant variation was observed in any of the above selected parameters during the 4-week control period, i.e., the period before the beginning of PRT.
2. After the strength training with PRT, leg maximal strength increased by 17.1 and arm maximal strength increased by 18.2%
3. Visceral fat decreased by 10.3%
4. Subcutaneous abdominal fat decreased 11.2%
5. No changes were observed in body mass index

In addition PRT

1. Significantly increased insulin sensitivity by 46.3%
2. Significantly decreased fasting blood sugar by 7.1%
3. A 15.5% increase in energy intake, i.e., calories was observed.

The conclusion of the study was that two sessions per week of PRT, without a weight loss diet, significantly improves insulin sensitivity and fasting sugar and decreases abdominal fat in older men with type 2 diabetes.

Exercise benefits – aerobic and PRT

In previous studies, the beneficial effect of physical conditioning on insulin sensitivity has been well established. Exercise training results in loss of fat from around the abdomen, and it seems that this loss of fat is closely related to an improvement in insulin sensitivity. Moreover, exercise alone in the absence of body composition change is able to improve blood sugar values.

Aerobic endurance exercise – walking, jogging, and swimming -- has traditionally been advocated as the most suitable exercise in the treatment for patients with type 2 diabetes. However, the American College of Sports Medicine (ACSM) has recently recommended the use of progressive resistance training (PRT) as part of a well-rounded exercise program for individuals with type 2 diabetes.

Muscle Loss Has Consequences for All

Typically, the normal man or woman, who makes no effort to maintain their muscle mass, will lose ½ to 1 pound of muscle per year after age 30. This means that if nothing is done to strengthen and exercise the muscles, at age 60, that same 30 year old, who weights the same as he/she did at 30, will have 15-30 pounds less muscle and 15-30 pounds more fat. In that abdominal fat is one of the principle causes of insulin insensitivity and type 2 diabetes, it is easily seen why so many are at risk for both.

The progressive loss of muscle mass and strength with aging is an important cause of frailty, disability, and loss of independence in the elderly, and older adults with diabetes are at increased risk of poor physical function. Exercise improves muscle and nerve performance in older people and is becoming recognized as effective increasing functional independence and decreasing the prevalence of many age-associated diseases, such as type 2 diabetes.

Training protocol in this study has implications for all

The design of this study gives guidance to all of us as to how to safely and effectively start and sustain a health-improvement program.

- A minimum of 2 days elapsed between two consecutive training sessions.
- Each training session included two exercises for the leg extensor muscles (bilateral leg press and bilateral knee extension exercises)
- one exercise for the arm extensor muscle (the bench press), and
- Four to five exercises for the main muscle groups of the body. Only resistance machines were used throughout the training period.

During the first 8 weeks of the training period, the subjects trained with loads of 50–70% of the individual muscle groups maximum with 10–15 repetitions per set and three to four sets of each exercise. During the last 8 weeks of the training period, the loads were 70–80% of the maximum, five to six repetitions per set (higher loads) and three to five sets.

In addition, from week 8 to week 16, the subjects performed a part (20%) of the leg extensor and bench-press sets with the loads ranging from 30 to 50% of the maximum.

Conclusion

The main findings of this study were that prolonged resistance training, twice weekly at intensities of 50–80% in older men with type 2 diabetes, led to significant

1. increases in muscle strength,
2. decreases in abdominal fat, and
3. Improvements in insulin sensitivity.

These metabolic improvements were present even with no variation in body mass and even with an increase in calories in the diet. Traditionally, if we want to improve health, we encourage a reduction in calories, with PRT; calories can actually increase as health increases.

Implications for You

As we continue to explore ways in which you can take responsibility for your own health, here is another. You don't have to do power lifting with massive weights to gain the benefits described above. You simply have to start where you are and consistently – two days a week – place your muscles in the strain of lifting 50-80% of what they are capable of with 3-4 sets of 10-15 repetitions. That's not much to ask for avoiding diabetes, or for improving the control of your blood glucose if you have diabetes.

Whether you are or aren't diabetic, it is your life and it is your health, and there is something you can do about it.