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Aging, Inactivity and Exercise

By: James L. Holly, MD

In the September 18, 2001, *Circulation* published a two-part study entitled, “*A 30-Year Follow-Up of the Dallas Bed Rest and Training Study.*” Part I was subtitled, “*Effect of Age on the Cardiovascular Response to Exercise,*” and part two was subtitled, “*Effect of Age on Cardiovascular Adaptation to Exercise Training.*”

The “longitudinal” nature of this study makes it particularly useful. This means that the data analysis is compiled by examining the same subjects over a long period of time as opposed to a “cross-sectional” analysis which is the result of data from the same point in time being analyzed. There are limitations to both kinds of study but each contributes unique perspectives to our understanding.

This “longitudinal” study took place over thirty years. While the group was relatively small, the issues addressed are very important to all who are interested in maintaining a good state of health and/or regaining health which has been lost through aging.

Here is the design of the study. In 1966, five healthy young adults (20 years old) were studied:

1. At baseline.
2. After three weeks of total bed rest
3. After eight weeks of intensive dynamic exercise training.

Then in 1996, the same five people were restudied

1. At baseline
2. After a six-month intensive exercise training program.

However, the following summary of the results of both studies gives great insight into how to prescribe activity for those who have decided they want to be healthy. The overall conclusion of these studies should be posted on every website in the world and should be given to every person seen in every clinic every day. Here it is: “**...three weeks of bed rest in 1966, caused a greater deterioration in cardiovascular and physical work capacity than did 30 years of aging in these five men.**”

This is startling. In a new and revealing way, it confirms what we have known, **inactivity is unhealthy**. For more information on this see, *Physical Inactivity: The*

Consequences of Being a Couch Potato in the February 26, 2004, *Examiner*, or go to www.setma.com to review this article. That article started with these questions:

- “Which will do more for the improvement of your health? Visiting the doctor or visiting the gym?”
- “Which will do more for the improvement of your health? Taking a pill or taking a walk?”
- “What can medicines do to help you avoid the consequences of your inactive lifestyle?”

The answer to the last question is: **nothing!**

Aerobic Power

The studies under review from *Circulation* state that cross-sectional studies have indicated that “aerobic power” declines in a straight line throughout adulthood. “Aerobic power” is defined as the maximum ability your body has to take up oxygen. It is expressed as “V dot O₂ max”. “Aerobic power” is closely linked with your body’s ability to consume – to utilize in the muscles of your body – the oxygen which is taken up by the blood as it passes through the lungs. While “oxygen uptake” and “oxygen consumption” are two different measures and two different concepts, they are closely linked. In differing circumstances, the oxygen uptake and the oxygen consumption can be equal or unequal. In a future discussion, we will explain how you can know your “aerobic power” and how, if it is not adequate for your health goals, you can improve it. For now, realize that the amount of oxygen you can take up into your body decreases as you get older.

Critical Power

There is one additional concept, not addressed in these two studies, which is important to this discussion. It is “critical power.” This is the “upper limit of the work rate at which both the maximum oxygen uptake and the blood lactate can be maintained at a high but constant level.” (Blood lactate is a by-product produced in your muscles when your body’s level of activity exceeds its ability to take up and/or to consume oxygen. You can know you are producing lactate from exercise when you start breathing hard, getting tired and ultimately having to stop your exercise because of fatigue.)

For healthy young subjects, the “critical power” is about 50% of their maximal oxygen uptake. The reason this is important is that at a person’s “critical power” they are able to maintain a level of activity for a very long period of time. This is why athletes are able to run 26 miles at a pace faster than most people can run one mile. In future discussions, we will address how it to do that, because while you may never train for a marathon, the knowledge of how to do so can help you achieve a higher fitness and therefore a higher wellness level at your own activity level.

Age versus inactivity

The age-related decline in aerobic power among these five middle-aged men occurring over 30 years was completely reversed by a 6-month endurance training program and after 30 years of aging, the studies in *Circulation* showed that “none of the subjects achieved an aerobic power lower than the post bed rest values 30 years before.”

Inactivity is a greater health risk than aging and inactivity will cause greater harm to your body's functioning than aging. **Three weeks of bed rest resulted in a greater deterioration of cardiovascular function in healthy young adults than 30 years of age.** In addition, more than face lifts, tummy tucks, botox or facial peels, physical activity will reverse many of the important, health-related effects of aging.

Furthermore, the conclusion of these two studies declared:

1. "Six months of endurance training restored 100% of the age-associated decline in aerobic power previously document in these five men.
2. "Despite this training effect, no individual achieved the level of aerobic power achieved after training 30 years previously.
3. "The mechanism of recover of aerobic power predominantly involved a peripheral adaptation to training evidenced by increase arterial-venous differences in oxygen content of the blood, with no change in maximal cardiac output. (The explanation of this phenomenon is beyond the scope of review but is included for completeness. We will address this in a future article."
4. "The relation of cardiac output and maximal oxygen uptake remained unchanged after six months of endurance training and after thirty years of aging."

The study concludes: "The observed 16% improvement in aerobic power...objectively demonstrates the effectiveness of our training strategy and is consistent with the results from other endurance training studies of healthy, non-athletic, middle-aged adults."

Limitation

There is a limitation, however. "No subject achieved the same maximal oxygen uptake attained after intensive physical training as young men." This really means that while physical activity can preserved your health, it cannot make you young again. Your body does change but you can improve the function of your body and physical activity can improve your risk of not getting cancer, diabetes, heart disease, osteoporosis, senility and a host of other debilitating illnesses.

One further limitation not addressed in these studies as we age, a major limitation to physical activity becomes our joints. Knees, shoulders, elbows wear out with use and abuse. Yet, even here training helps. Strengthening and stretching exercises can help improve the function of joints, particularly their stability in order to support the training required to achieve cardiopulmonary health.

What Level of Activity

If you have read this far, you should be interested in knowing what activity was required in order to restore the aerobic power of a 20 year old to a 50 year old. Based on their level of function at 20, each of the 50 year old subjects was given an "exercise prescription". Here is what they did to achieve these remarkable results:

1. Subject one jogged/walked 5.6 miles in 69 minutes four days a week.
2. Subject two jogged 5 miles in 43 minutes five days a week.

3. Subject three jogged worked out on a stationary cycle ergometer. He pedaled for 285 minutes a week at an average of 80% maximal heart rate in 4 exercise sessions a week.
4. Subject four jogged 4 miles in 41 minutes four days a week.
5. Subject five walked three miles in 44 minutes seven days a week.

No Injuries

The study reports that all subjects completed their training without injury. The reasons are instructive for anyone wishing to achieve the same results in their own training program:

1. Subjects were allowed to choose the mode of exercise they enjoyed.
2. The initial training dose was mild, allowing subjects to accommodate to the training program before attempting more rigorous exercise.
3. The use of wristwatch-style heart rate monitors allowed the subject to adjust the intensity of their training sessions and probably prevented overly intense exercise that often results in exhaustion, soreness, injury and resultant noncompliance.
4. Weekly adjustment of the individualized training prescription maintained a gradual but constant increase in the training dose and provided an opportunity for positive feedback and encouragement from the investigators.

What can we learn?

There are a number of technical issues addressed in these two studies which are valuable; none are necessary to understand in order to benefit from this remarkable research. For those interested in reading the studies for themselves the references are: *Circulation* 2001;104:1350-1357 and *Circulation* 2001;104:1358-1366.

Here is what you need to know:

1. There is a decrease in your physical well-being with age.
2. There is a decrease in your physical well-being with inactivity.
3. There is a greater decrease in your health from inactivity than from aging.
4. The physiological effects of aging on your heart, lungs and muscles can be decreased and in some ways eliminated by physical training.
5. No pill, surgery or other medical procedure can do for you what you most do for yourself – get active, stay active and train your heart, lungs and muscles through activity.
6. The key to maintaining and/or regaining your health are:
 - a. Get started with an exercise program.
 - b. Go slow at first.
 - c. Increase your work gradually.
 - d. Keep going.
 - e. Train all of your muscle groups including upper and lower body – arms and legs.
7. As evidenced from the five subjects involved in this study, physical training for health is not a competitive sport. It doesn't make any difference what your

friend or neighbor is doing or can do. The only thing that matters is that you are doing what you can.

8. To get maximum benefit, you need a personalized exercise prescription. Ask your doctor or healthcare provider for one. At SETMA, we can give you one every time you are in the clinic. (Also, see the *Examiner*, February 5, 12, 19, 2004, *Exercise: Getting Started Part I, II, III* or visit SETMA's website at www.setma.com)

Next week, we'll discuss how you can find out what your aerobic power and your critical power and how you can increase both.

Remember, it is your life and it is your health. It is also your responsibility.