

## Strategies in the Prescription of Exercise for Health in Adults

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**Figure 1**

### Prologue

At present, physical inactivity is considered by the most prestigious researchers in the field of health and sports sciences as one of the main public health problems of the 21st century.

The populations that we call "special", that is, that have characteristics that differentiate them from the others, are very sensitive to inactivity. Overprotection, fear or ignorance make sedentary groups such as diabetics, hypertensives or disabled who would benefit much from a prescription of physical exercise adapted to their characteristics and possibilities.

The benefits of physical activity for health are evident, but not all population groups respond similarly to exercise, nor can the intervention be planned in the same way.

Nor is it known with certainty the type, duration and intensity of the practice of physical exercise more convenient for each age group or specific group of population, being necessary works and

projects that focus their priority in solving and clarifying these gaps.

Dr. Juan Castellano research focus in the recovery and training of the physical condition in the adult population.

Dr Castellano approach is based on a high experience working with population groups that demand recovery and education in order to prevent and treat diseases and especially acquire healthy habits.

### Bibliography consulted

To create this article we have done a wide review on the scientific evidence of the exercise in relation to its effectiveness in improving health, knowing whether it can reduce the future risk of certain diseases, improve the quality of life and the level of physical condition.

We have recorded data on all systematic reviews, meta-analyses and controlled trials in pubmed, Pedro, Cochran, Elsevier.

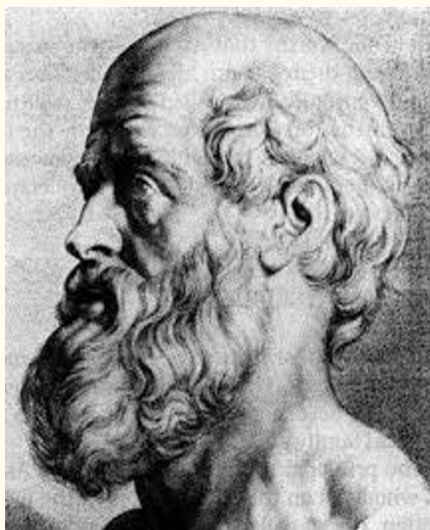
### Healthy life style

It is one that allows good health, understanding health not as a mere absence of disease, but as a condition that will allow individuals to develop their physical and mental possibilities to the maximum, along with their somatic and psychic wellbeing. The interaction between genetics and environment is the basis of health and disease.

It is necessary to point out that people respond differently to environmental and lifestyle factors, depending on their genetic characteristics. However, the effects of genes can be modified by the interaction of environmental factors, including the Diet and exercise.

In the year 480 a. of C. Hippocrates recognized that several aspects of what we now call "lifestyle" should be taken into account to achieve physical health. As he said:

"Positive health requires knowledge of the primary constituents of man and the power of various foods, whether natural or resulting from human ability. But eating is not enough to achieve health. You must exercise. The combination of these two factors must be carried out according to the season of the year, the changes of winds, the age of the individual and the situation of his house. If there is a deficiency in diet or exercise, the body will feel sick".



**Figure 2:** Hippocrates. Father of Medicine. Cos, Greece 460 ac. "The natural forces that are inside us are what really cure our diseases".  
"It is more important to know what kind of person a disease has than to know what kind of disease a person has".

### Quality of life

One of the most widely used definitions is that of the World Health Organization, which defines quality of life as "the perception of an individual of his position in life, in the cultural context and the system of values in which he lives, in relation to with its goals, objectives, expectations, values and concerns "

The quality of life related to health integrates aspects related to the welfare state, which can be grouped into four sections:

- o Physical state and functional capacity
- o The psychological state and well-being
- o Social interactions
- o The economic state.

### The movement is the most effective tool of conservation, recovery and improvement of the physical condition

In the year 2005 the journal Science in its editorial of January 21 states that the main chronic diseases such as cardiovascular disease, cancer, diabetes and chronic obstructive pulmonary disease, cause 50% of mortality. This mortality is supported by environmental causes such as smoking, inadequate diet and physical inactivity.

### Why physical activity?

The first studies that begin to relate physical activity with the lowest mortality are from an English doctor named Jeremy Morris. This researcher studied with his work group, the mortality by cardiovascular diseases in the workers of the English buses of two floors. Intelligently they compared the mortality among the drivers, who did a sedentary physical activity, in front of the collectors, who walked and climbed numerous times the stairs of the buses during long working days. Then they repeated the study comparing telephones with postmen. With these works, published in the Lancet journal, the authors concluded that bus collectors and postmen had a third less risk of cardiovascular disease than drivers or telephone operators, due to the greater physical activity of their work (Morris and Col. 1953)

This is one of the first epidemiological references on the effects of physical activity in the prevention of the disease.

The level of physical activity is dramatically decreasing even in young people (Nader 2008) and in adults.



Figure 3

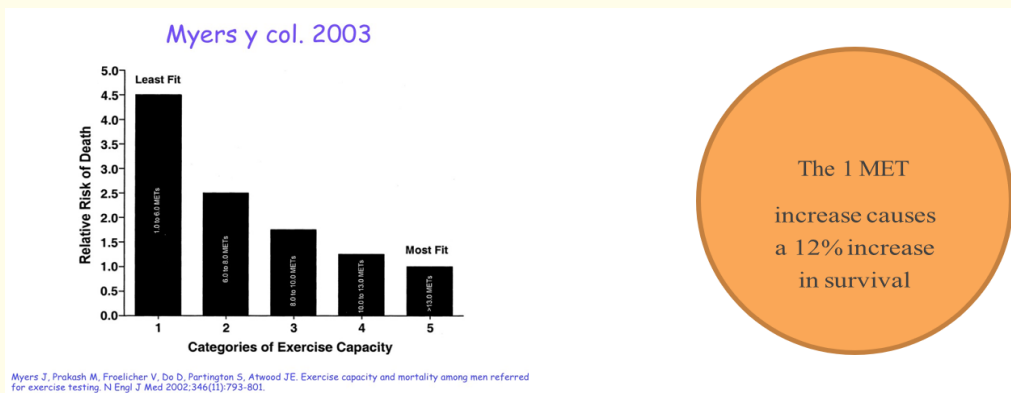


Figure 4



Figure 5

Physical inactivity causes 6-10% of chronic diseases. It is estimated that sedentary lifestyle causes 3.5 million deaths per year, equivalent to smoking (Lee 2012). Life expectancy would increase

by 0.68 years. If the inactive became active, life expectancy would increase between and 3.7 years (Paffenbarger 1986, Franco 2005).

### Bases and general principles on the prescription of physical exercise for health

We consider that the main objective of the prescription of an exercise program should be:

- o Help your practitioners improve their health.
- o Reduce the future risk of certain diseases.
- o Improve the quality of life and level of physical condition.

### Dose - effect

The benefits of physical activity are dose-dependent from a scientific point of view so the definition of what is a sufficiently active subject is arbitrary.

## Intensity

Nowadays doctors recommend for health to perform moderate physical activity with exercises that require a sufficient energy expenditure and that increase strength.

This corresponds to doing up to 150 minutes per week of physical activity. However, one must consider non-modifiable factors such as age.

For example, during adolescence (14-19 years of age), an active subject is considered to be a person who performs a minimum of 60 minutes of moderate-intensity daily physical activity. Additional benefits would be obtained during the 300 minutes per week.

Each person needs a certain volume of physical activity to obtain substantial benefits. For example, to increase the maximum bone mass it would be sufficient to carry out 10-15 minutes a day of activities that produce large impacts on the osteo-articular system (such as jumping) for 3 days a week

- Following these premises, exercise programs in general should be focused mainly on the meters most related to adult health.

Parameters more related to health:

- Body composition
- Cardiorespiratory resistance
- Muscular strength and endurance
- Myofascial and joint flexibility

## The exercise in body composition

Benefits produced by physical activity on various body systems:

### Adipose tissue

Many observational studies have shown the importance of regular physical activity for the prevention of overweight and obesity.

Physical activity has been shown to be particularly effective for the loss of visceral fat compared to caloric restriction, which entails a lower metabolic risk.

At present there is no consensus on what the right amount and type of physical activity for that purpose is. In 2002, the Institute of Medicine of the United States recommended 60 minutes a day of moderate intensity physical activity.

Other authors point out the importance of increasing other levels of physical activity (more hours of light physical activity) to prevent fat gain.

### Muscular system

Regular physical activity throughout life is probably the best intervention to prevent the loss of muscle mass, strength and function associated with aging. The type of physical exercise that produces the greatest increases in skeletal muscle mass are strength exercises. A recent meta-analysis has shown that strength training in early ages is more effective in gaining muscle mass than in later ages. In addition, high exercise volumes produce greater adaptations than low volumes. Overload training produces benefits from childhood, provided it is performed by qualified personnel.

### Osseous system

Physical activities that require large applied forces in a short time produce bony adaptations (such as increased bone mineral content, structural improvements) that can prevent osteoporosis at advanced ages. In addition, there are data that indicate that the benefits may last even if the levels of physical activity in the late age decrease. However, it is important to be clear that only certain periods of life and certain physical activities allow optimal development of bone mass and structure. Great forces applied in a short period of time (for example, through activities such as jumping or hitting) have the greatest osteogenic effects. Racquet sports, volleyball and artistic gymnasia, produce optimal bone health in the members who request the most. For jumps, it has been estimated that those activities that produce reaction forces greater than 3.5 times the body weight and applied in less than 0.1 seconds would be the most osteogenic.

### Nervous system

Physical activity during the first years of life is fundamental for the correct development of basic motor skills (such as running, jumping, manipulating and throwing objects). In a recent review, a positive association has been observed between a high level of development of these basic motor skills with levels of physical activity and cardiorespiratory fitness in the first decades of life. In addition, a lower level of development increases the risk of obesity.

On the other hand, a high level of physical activity (aerobic) reverses the memory losses associated with aging due to factors such as improved perfusion of the brain areas and the most optimal creation of nerve cells.

### Cardiovascular system

At present, there is a high degree of scientific evidence that cardio-vascular diseases are associated with physical inactivity. The mechanisms that preserve vascular health have been described in detail in several reviews.

In recent human intervention studies, benefits on the cardio-vascular system were increased to a greater extent by combining physical exercise and caloric restriction versus exclusive caloric restriction. Therefore, physical exercise is one of the fundamental pillars to preserve the health of the cardio-vascular system.

### Metabolic system - digestive

The epidemic of type II diabetes is a threat to the economy and population health of most developed countries. Unhealthy diets coupled with sedentary lifestyles largely explain this epidemic.

Although the risk of type II diabetes is higher in subjects with family predisposition or obese subjects, it is estimated that a high level of physical activity decreases the risk by 20-30%.

However, there is evidence that subjects at risk of developing type II diabetes, the performance of regular physical activity has a greater importance than in subjects without predisposition, which can accumulate less physical activity without developing the disease.

Subjects at risk should perform at least 210 minutes per week of moderate physical activity and at least 2 days of strength training.

### Cardiorespiratory resistance

In the last decade, several studies have shown that high levels of cardiorespiratory resistance are associated with a lower risk of cardiovascular disease. The activities that involve large muscle groups rhythmically and continuously, with an intensity and adequate duration (aerobic exercise 20 minutes), are those that increase the maximum oxygen consumption and make the cardiovascular and respiratory systems work properly.

In the prescription of physical exercise in relation to cardiorespiratory endurance, a frequency of 5 days of exercise with a moderate intensity is recommended in periods of 30-60 minutes that involve the largest muscle groups with a volume of 500-1000 MET/week.

The sessions can be done continuously or in brief periods of 10 minutes accumulating the duration and the desired volume (inter-

val exercise). The progression must be gradual, adjusted to the rest of the elements and to the objectives and characteristics of each person.

In the prescription of physical exercise it is interesting to classify the groups of cardiorespiratory resistance activities

### Strength and muscular resistance

The strength and muscular resistance have always been the most important point of study in terms of knowing the dose of exercise in the prescription of physical exercise. Scientific studies have shown that high levels of muscle strength are associated with lower metabolic risk, decreased mortality, fewer episodes of cardiovascular disease, lower risk of developing functional limitations and non-fatal diseases. All activities (including those of daily life) require a certain percentage of strength and muscular endurance of the individual. The maintenance or improvement of muscular shape and resistance makes it possible to perform activities with less physiological overload.

It is necessary to know the distinction between strength and muscular resistance.

Strength is defined as "the ability of the muscles to generate tension and overcome a resistance", while muscular endurance is "the ability of the muscles to apply a submaximal force repeatedly or maintain a muscle contraction for a period of time dragged on".

In the prescription of physical exercise in relation to muscular strength and endurance, a frequency of 2-3 days a week is recommended, training large muscle groups with a moderate intensity (50-70% of 1 RM in a healthy adult) from 2 to 4 series running 8-12 repetitions for the improvement of muscle strength and 15-20 repetitions for muscular endurance with a break between sets of 2-3 minutes and 48 hours between sessions.

The progression must be gradual adapting it to all the elements of the physical prescription.

Muscular strength works best with free weights or high loads that develop greater muscle tension. The work done with elastic rubbers, pulleys, flexible bars, etc., allows the development of muscular resistance (lighter loads and greater number of repetitions).

### Articular and myofascial flexibility.

One of the biggest drawbacks to adapt certain populations to physical exercise is the lack of joint and muscle flexibility.

This is defined as "the functional capacity of a joint to move throughout its range of motion". It is specific to each joint and depends on the anatomical characteristics of the joint surfaces and the tissues surrounding the joint.

Flexibility decreases with aging, despite this, it is essential to maintain an optimal state of joint mobility. Studies in the scientific literature confirm that flexibility and the range of joint mobility can be improved at all ages.

In the prescription of physical exercise in relation to flexibility, we recommend cyclical exercises such as light gait for at least 10 minutes before performing static activities that generate overloads and specific stretches of 10 to 30 seconds that cover large muscle groups.

There are various methods of stretching but the general recommendation is that the muscle exercise series encompass large muscle groups with a total volume of 60 seconds and 2-4 repetitions per stretching exercise. The optimal progression in flexibility work is still not known but it is known that it is more effective after activation of the musculoskeletal system through a previous work of aerobic resistance of moderate mild intensity.

### Motor control

This type of exercise refers to motor skills such as balance, coordination, gait, agility and proprioceptive training. Activities such as Pilates, Yoga and Taichi are based on motor control and are very suitable for prescription programs of physical exercise aimed at adults and the elderly.

It is recommended a frequency of 2-3 days per week with exercises of a duration of between 20- 30 minutes, that is a duration of 60 minutes per week. The intensity, volume (repetitions, series), and progression, are not yet known with accuracy.

The Pilates method provides training with conscious exercises that initially require a high degree of motor control. The medical community is increasingly recommending this method of exercise for its contribution to the mind-body and its benefits.

### Duration of the exercise

The duration of the exercise is a function of the intensity and fundamentally of the level of physical condition of the participants. The lower the level of physical condition the shorter the duration of the sessions.

The general recommendations indicate that it should begin for a duration of 12-15 minutes and will be increased up to 20 minutes, without counting the warm-up or the return to calm.

The duration must be sufficient to increase the energy expenditure by 1200 kilojoules (287 kcal) as a minimum. In individuals with little tolerance to exercise, the effort should be divided into small phases, interspersing rest breaks. Subsequently the duration of the exercise period will be increased, reducing the number of periods and rest until the exercise becomes continuous at the end of the start stage.

In the stage of improvement or progression the goal would be to increase the duration up to 30 minutes. The duration in the maintenance stage will be in accordance with the objectives of the exercise program.

The key is to know how to relate duration to intensity. The same energy expenditure can be achieved either by decreasing the duration and increasing the intensity or increasing the duration and decreasing the intensity. Knowing the physical condition of the participant is essential to know how to combine both parameters.

### Frequency of exercise

The frequency is interrelated with the duration, intensity and type of exercise. It is important to take into account the functional capacity of the subject.

- People with functional capacity < 3 METs: they must perform multiple daily short sessions (5-10 minutes).
- People with functional capacity between 3-5 METs: from 1 to 2 sessions a week.
- People with functional capacity > 5 METs: 3-5 sessions a week.

The number of weekly sessions varies according to the objectives of the program, the preferences of the participant and the limitations imposed by their way of life. At the beginning a frequency of 3 sessions a week on alternate days is recommended.

### Principles on exercise prescription

A program of prescription of physical exercise must take into account a series of elements:

#### In addition to these aspects are

1. The frequency
2. The Duration
3. Individuality

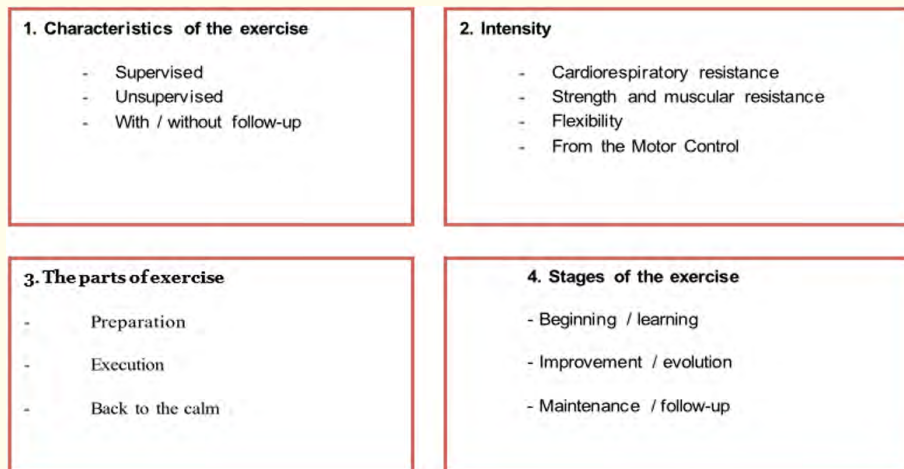


Figure 6

### Types of exercise

There are no differences in carrying out activities of one kind or another if the criteria of duration, intensity and frequency of the activity are maintained. They should simply be adapted to the physical characteristics of the individual, attend to their interest in the activity, enjoyment provided, time available and access to necessary equipment and facilities.

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