

# Clinical Exercise Physiology: The role of exercise physiology in chronic diseases

## Fisiología clínica del Ejercicio: la fisiología del ejercicio aplicada a las patologías crónicas

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General physiology deals with the functioning of the organism and its parts, whilst the physiology of exercise is the branch of physiology that studies the functioning of the body during physical exercise and the adaptations that it provokes when it is performed regularly.

The clinical physiology of exercise, which I will refer to as clinical physiology, studies the response to physical exercise of patients with chronic illnesses (psychiatric, neurological, metabolic, cardiovascular, pulmonary), the limitations they display to it, and uses knowledge acquired by the physiology of exercise to cause adaptations induced by physical work as another therapeutic resource (prescription of therapeutic exercise).

Over the last 60 years, scientific evidence relating to physical exercise-health has increased, but since the last decade of the 20th century not only has it become clear and resounding, but also unarguable and accepted by the vast majority of scientific societies and organisms, such as the World Health Organisation.

Scientific evidence acknowledges that physical condition is an excellent predictor of life expectancy and quality of life. Over recent years, numerous studies have revealed an inverse association between physical condition and morbi-mortality in the population, very marked in patients with cardiovascular risk factors. Improvements in both physical and mental health are observed.

Physiological values such as maximum consumption of oxygen (VO<sub>2</sub> max.) constitute an excellent marker of the maximum cardiovascular capacity, observing an almost linear relationship between the reduction of mortality and the increase of physical condition (METs). Therefore for each MET of improvement, there is a 12 % increase in life expectancy in men and 17% in women. These figures indicate that poor physical condition is an added risk factor, as well as a morbi-mortality predictor.

Along with this evidence, it is observed how the physical inactivity of a large part of the population is responsible for the reduction in functional capacity: cardiovascular, metabolic, as well as in muscle strength, which increases the incidence-prevalence of chronic illnesses when it does not make them worse.

It has been highlighted that the most important health benefits gained from physical exercise focus on cardiovascular or metabolic illnesses, those affecting the locomotive apparatus, certain types of cancer and psychiatric illnesses.

The latest studies place physical inactivity among the 5 top causes of the overall risk of mortality on a world scale, and as the cause of a major economic cost for health systems.

Thus, either physical inactivity is the direct responsible element behind the appearance of these pathologies, or, as observed in clinical practice, the appearance of a primary illness (excess weight-obesity, cardiovascular, diabetes, etc.) results in a deficit that provokes the physical inactivity of the patient, a progressive loss of functional capacity, closing a perpetuating cycle of the progressive reduction and worsening of the state of health.

Performing regulated physical exercise on a regular basis (correctly prescribed depending on medical and physiological criteria: clinical physiology) can reverse this process.

The good praxis of clinical physiology requires: a thorough knowledge of the medical pathology, of the physio-pathology of the exercise and of the use of the most appropriate functional assessment tests.

These tests for the functional assessment of the physical condition can be sophisticated and complex: ergometric, ergo-spirometric, isokinetic or simple, such as the 6-minute walking test, or the hand dynamometer.

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Therapeutic physical exercise should have some specific characteristics and be orientated towards the improvement of some of the qualities of the physical condition that are related to health, giving way to beneficial effects for it, such as: the reduction of blood pressure, the improvement of tolerance to glucose, the positive modification of the lipid profile, the increase of muscle and bone mass, among others.

Prescribing exercise should be based on its customisation, i.e. adapting the prescription as far as possible to the characteristics of each patient. The frequency and duration are still generally accepted standards, but there should be a more in-depth analysis of physiological customisation in the re-training programme (intensity). There are different approaches to this physiological customisation, among which are: ventilatory, lactate and dyspnoea thresholds, the visual analogue scale, as the most used.

In addition to the physiological perspective, the prescription should also be customised, taking into account the associated pathologies present in the patient, the medical treatment being followed, and the socio-cultural and economic level.

To prescribe physical exercise safely, recommendations, warnings, and the reduction of risk should be taken into account as another of the priority objectives.

The experience acquired over these years and the bibliography consulted confirm the need to routinely include the evaluation of the physical condition in the control and clinical follow-up, as a base for the prescription of physical exercise and its evolutionary control. Specifically, and in the majority of patients: the 6-minute test to assess aerobic resistance (distance covered) and to calculate the  $VO_2$ max. indirectly and the strength test as the hand dynamometer. If necessary, more specific tests will be carried out, such as: ergometries, ergo-spirometries, isokinetics of the lower extremities.

The physical exercise programme proposed is intended to be easy to prescribe, without the need for complicated or complex complementary tests, easy for the targeted patients to follow, both in terms of the type of exercise to perform as well as their intensity (note that the majority are sedentary patients).

The main aim is to improve the physical condition qualities that are linked to the reduction of cardiovascular risk and that of morbi-mortality:  $VO_2$ max, tolerance to aerobic exertion-resistance, muscle strength.

Finally, negative effects should be avoided: dropping out, locomotive system injuries, increased cardiovascular and metabolic risk, for which the periodical supervision of these patients by medical specialists in clinical physiology is required.

In short, therapeutic physical exercise designed from clinical physiology becomes a "polypill", as described by some authors, and is an essential part of medicine, as highlighted equally in the United States by American College of Sports Medicine: "Exercise is Medicine", as well as in Europe by Pedersen and Satin: "Exercise is Medicine".

Since the second half of the 20th century, the physiology of exercise applied to sporting performance has undergone extraordinary development, both on a world scale as well as in Spain, positioning us as a benchmark country in this sphere. However, in the area of clinical physiology, development in Spain has not been aligned with that occurring internationally.

There are medical groups of the clinical physiology of exercise in our country, researchers and some highly interesting public and private initiatives that are undertaking this task, but in an isolated and uncoordinated way, and the very few that are stable and official form part of the public and private range of medical services.

It can also be observed that there is a profound lack of knowledge of this branch of exercise medicine on an institutional level by the majority of private health insurances, and even by our medical colleagues.

I believe that it is time to revalue and vindicate this area of our speciality. I would like to put forward some proposals from the recognition of the difficulty of this task in the socio-economic and health situation we are currently experiencing:

- As doctors, specialists in Sporting Medicine, we should aim to give our very best by deepening our training and keeping up to date with the clinical physiology/prescription of exercise.
- Gather the support of scientific societies and medical groups. In this respect, the Spanish Society of Sporting Medicine is taking the (already advanced) steps of providing training and updating courses in physiology and the prescription of physical exercise.
- Manage to enable the general public to get to know clinical physiology and its necessary presence in the health care offer to citizens.
- Raise the awareness of those responsible for healthcare so that they invest in a medical area that in the mid and long term improves the health of individuals and populations and represents a saving for public healthcare services.

The task is far from simple, but health and the quality of life of our fellow citizens deserve it, and scientific evidence and current economies require it.

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