

# **Course n°2**

## **Sport, Physical Activity and Health**

Benefits and Risks of Exercise Prescription

## Learning objectives of the course

Upon completion of this course, the student will be able to:

- List the main benefits of physical activity on the cardiovascular, metabolic, and mental systems, and the prevention of chronic diseases.
- Identify the risks associated with poor prescription or excessive practice.
- Apply the basic principles of a reasoned exercise prescription (FITT-VP model).
- Adapt practice to different populations (beginner, sedentary, athlete).

## Introduction

Regular physical activity (PA) is recognised as one of the best preventive treatments. The World Health Organization (WHO) estimates that physical inactivity is responsible for 3 to 5 million deaths per year worldwide.

However, poor prescription can lead to injuries, overtraining, or even serious accidents (cardiovascular). The sports professional must know how to maximise benefits while minimising risks.

### 1. Beneficial effects of physical activity

#### 1.1 Effects on the cardiovascular system

- Reduction in blood pressure:  $-5$  to  $-7$  mmHg in hypertensive individuals.
- Improved lipid profile:  $\uparrow$  HDL (good cholesterol),  $\downarrow$  triglycerides.
- Reduced risk of coronary artery disease:  $-20$  to  $-35$  %.
- Increased aerobic capacity ( $VO_2\max$ ):  $+15$  to  $25$  % after 3–6 months.

**Mechanisms:** improved endothelial function, increased vascularisation, reduced inflammation.

#### 1.2 Effects on metabolism

- Prevention and treatment of type 2 diabetes: improved insulin sensitivity (acute and chronic effects).
- Body weight regulation: energy expenditure, increase in lean mass.
- Reduction of metabolic syndrome (combination of hypertension, hyperglycaemia, abdominal obesity).

#### 1.3 Effects on mental health

- Reduction of anxiety and depressive symptoms: efficacy comparable to mild to moderate antidepressants.
- Improved self-esteem and body image.
- Neuroprotective effect: reduced risk of cognitive decline and Alzheimer's disease ( $\rightarrow$  increase in BDNF, a neurotrophic factor).
- Better stress management: lower cortisol, increased endorphins.

## 1.4 Prevention of chronic diseases

Disease	Risk reduction with regular PA
Colon cancer	-30 to 40 %
Breast cancer	-20 to 30 %
Osteoporosis	-30 to 50 % (fractures)
Alzheimer's disease	-25 to 40 %
Chronic obstructive pulmonary disease	-20 to 30 %

## 1.5 Other benefits

- Improved sleep (faster falling asleep, increased deep sleep).
- Strengthened immune system (fewer ENT infections in moderate exercisers).
- Longevity: 3 to 7 years of life gained in active individuals.

**Note:** PA protects against more than 30 chronic pathologies. It is the most universal drug.

## 2. Risks associated with poor prescription

PA is not without danger if it is poorly prescribed, poorly performed, or excessive.

### 2.1 Overtraining

**Definition:** imbalance between training load and recovery, leading to persistent fatigue and decreased performance.

**Signs (to watch for in your athletes):**

- Morning fatigue, non-restorative sleep.
- Decreased performance despite training.
- Irritability, anxiety.
- Recurrent infections (oropharynx, urinary tract).
- Diffuse muscle pain.

### 2.2 Musculoskeletal injuries

Most frequent:

- Tendon injuries (tendinopathies).
- Muscle injuries (strain, tear).
- Ligament injuries (ankle or knee sprain).
- Stress fractures (especially in women and runners).

Aggravating factors:

- Too rapid increase in volume or intensity (10% rule not respected).
- Poor recovery.
- Biomechanical defects.
- Inappropriate surface.

### 2.3 Cardiovascular risks

**Sudden death:** rare in healthy subjects, but mainly occurs in individuals with an unrecognised heart condition (e.g., hypertrophic cardiomyopathy, coronary anomaly).

**Myocardial infarction/cardiac stroke:** transiently increased risk during intense exertion (on an unstable atheromatous plaque).

**Rhythm disorders (atrial fibrillation):** excessive endurance sport associated with an increased risk of atrial fibrillation.

### 2.4 Hormonal disorders (RED-S – previously discussed)

- In women: amenorrhoea, ovulation disorders.
- In men: decreased testosterone, decreased libido.

### 2.5 Other risks

- **Dehydration / hyponatraemia (due to excess water without electrolytes).**
- **Exercise-induced asthma (in predisposed individuals).**
- **Rhabdomyolysis** (massive muscle breakdown after extreme effort, especially in beginners).

**Key message:** Zero risk does not exist, but a reasoned prescription greatly reduces accidents.

## 3. Reasoned exercise prescription (FITT-VP model for a healthy population)

This model is used by the American College of Sports Medicine (ACSM). It should be mastered to adapt PA to any population.

Letter	Meaning	Recommendations for a healthy adult
F	Frequency	At least 3–5 days/week
I	Intensity	Moderate (50–70% HRmax) or vigorous (70–85% HRmax)
T	Time (duration)	30–60 min (or cumulative 150 min/week of moderate activity)
T	Type	Endurance, strengthening, flexibility
V	Volume	>500 MET-min/week
P	Progression	10% rule (do not increase by more than 10% per week)

## Simple intensity calculation

- Target heart rate =  $(HR_{max} - HR_{rest}) \times \%intensity + HR_{rest}$ .
- Borg scale (RPE): 6 = rest, 20 = maximal effort. Target = 12–15 (moderate to vigorous).

## Example prescription

For a sedentary adult aged 40:

- F = 4 times/week
- I = 60% HR<sub>max</sub> ( $\approx$  120 bpm)
- T = 30 min
- T = brisk walking or cycling
- V = 120 min/week moderate
- P = +10% duration after 2 weeks without pain

For athletes: recommendations differ (more intense sessions, interval training, recovery).

## 4. Special populations: adapting the prescription

The sports professional's role also includes supervising specific populations.

### 4.1 Elderly ( $\geq$ 65 years)

- Major benefits for fall prevention, bone density, independence.
- Recommendations: prioritise balance work + moderate strengthening + flexibility.
- Relative contraindications: uncontrolled hypertension, severe osteoarthritis, high fall risk.

### 4.2 Pregnant women (without contraindication)

- PA recommended (30 min/day of moderate intensity).
- Avoid: supine position after first trimester, sports with risk of impact or falls.
- Stop signs: bleeding, contractions, excessive shortness of breath.

### 4.3 Common chronic diseases

Condition	Adaptations
Type 2 diabetes	Monitor blood glucose before/after. Avoid hypoglycaemia if on insulin.
Hypertension	Avoid intense static efforts (maximal weightlifting).
Asthma	Long warm-up, use bronchodilator beforehand if needed, avoid dry cold air.
Osteoarthritis	Prefer cycling, swimming, avoid impacts.
Obesity	Start with non-weight-bearing activities (swimming, cycling), progress slowly (knees).

#### 4.4 High-level athletes (risk prevention)

- Close medical monitoring (pre-season check-up, ECG, echocardiography if risk).
- Daily monitoring (RPE, sleep, HRV).
- Scheduled rest (recovery weeks, unloading periods).

#### 5. Example programmes according to objectives

- Beginner / return to PA programme (e.g., sedentary patient)
- Weeks 1-2: walking 20 min, 3x/week, light intensity (Borg 10-11).
- Weeks 3-4: brisk walking 25 min, 4x/week, moderate (Borg 12-13).
- Weeks 5-6: walking + stairs, 30 min, 4-5x/week.
- Beyond: add cycling/swimming endurance, light strengthening.
- Amateur sports programme (football, running)
- 2 endurance sessions (45 min, 70% HRmax) + 2 strengthening sessions (eccentric, proprioception) + 1 interval session.
- Monitor signs of overtraining (1 day of active rest per week).
- One unloading week every 4-6 weeks (-30% volume).

#### Appendix: Practical sheet – Modified Borg scale (RPE)

Level	Sensation
6	Absolute rest
7-8	Very, very light
9-10	Very light
11-12	Fairly light (warm-up)
13-14	Somewhat hard (aerobic threshold)
15-16	Hard
17-18	Very hard
19-20	Extremely hard (maximal)

Health target zone: 12-15 (moderate to vigorous).