

UNIT 2: PHYSICAL CONDITION

Physical fitness can be defined as the state in which our basic physical abilities are. The capacity to perform daily work with energy and effectiveness, delaying the onset of fatigue and preventing injuries. Also known like **general fitness** that include **endurance, strength, flexibility and speed**.

Let's study each one individually.

1. ENDURANCE (Stamina)

1.1 Concept.

It is the **physical and psychological** ability to resist fatigue in long and low/medium intensity activities.

1.2 How can we control the intensity of the exercise?

To control the intensity of the activity, consider your **heart rate (HR)**. Your heart rate is how many times your heart beats per minute.

Your **maximum heart rate (MHR)** is 220 minus your age. ($MHR = 220 - \text{age}$).

Heart rate reserve (HRR) is the difference between resting heart rate (HR_{rest}) and maximum heart rate (HR_{max}).

$HRR = HR_{max} - HR_{rest}$ ($HR = 220 - \text{age in years}$; HR_{rest} = number of beat that you count in 60 seconds)

Heart rate reserve is used when **determining exercise heart rates**.

Your target heart rate zone (to aerobic endurance) is between **55% and 85%** of your HRR.

The target heart rate zone is the area between:

- The minimum level of activity needed to achieve fitness and
- The maximum level of activity for safe/healthy exercise

The Karvonen formula is used to calculate exercise heart rate (HR) at a given percentage training intensity. Add the given percentage of heart rate reserve to the resting heart rate.

Exercise HR = % of target intensity ($HR_{max} - HR_{rest}$) + HR_{rest}

For example: Target intensity 70 % HRR for a person with HR_{max} 201 bpm and

HR_{rest} 50 bpm

Exercise HR = 70% (201-50=151) + 50

Exercise HR=155 bpm

Now you! Which is your rest heart rate? HR_{rest} = _____ bpm.

Which is your HR_{max} ? HR_{max} = _____ bpm.

Which is your heart rate for a minimum and maximum aerobic training intensity?



1.3 Types of endurance.

Depending on the energetic ways and the intensity of the effort, there are two types of endurance:

A) **Aerobic endurance.**

It is the ability to do long and low-intensity activities. This is developed using continuous and interval running. The heart rate in this activity is between 55% and 85% resting heart rate (RHH).

The body works at a level whereby the **demands for fuel and oxygen** can be met by the body's intake **during aerobic work**. Carbon dioxide and water are the only waste products that are formed. They are excreted from the body through breathing and **sweating**. **Main energy source are lipids and glycogen with oxygen (aerobic).**

Examples: jogging, walking, cycling, swimming (long distances), dancing, aerobic...

Aerobic endurance is sub-divided into:

- **Short aerobic** -2 minutes to 8 minutes (aerobic/lactic)
- **Medium aerobic** -8 minutes to 30 minutes (mainly aerobic)
- **Long aerobic** -30 minutes + (aerobic)

Long distance cyclists and marathon runners are known for their aerobic endurance. You breathe heavier than usual during aerobic exercise. However, **the supply of oxygen** in your body should be efficient such that you can be able to carry on a conversation while doing the aerobic exercises. **You start using anaerobic energy** when you reach 70% of your HRR.

B) **Anaerobic endurance.**

Anaerobic endurance refers to the performance of **shorter, high-intensity exercises that do not rely on oxygen to be completed**. It is the ability to do short but intense activities (not more than three minutes).

Examples: short distance swimming, short distance races, cyclist and running sprints,

There are **two types** of anaerobic endurance:

- **Anaerobic non-lactic endurance:** The length of the exercise is short (max. 15 seconds) at a high intensity. For instance: 80 meters race. **Waste product are not toxic.**

- **Anaerobic lactic endurance;** the length of the exercise is 20 or 30 seconds at a high intensity, but not for a long time. For instance: 400 meters race.

This kind of exercise produces a toxic **waste product named lactic acid**. Lactic acid muscle accumulation could stop the exercise. Hold the accumulation of lactic acid is one of the effects of training on anaerobic lactic endurance. (Remember the sensation in your quadriceps when we practiced isometric squad.)

1.4 How can you improve your aerobic endurance?

Endurance can be improved with a variety of physical activities, such as jogging, running, swimming, cycling, canoeing ...

We can emphasize **two training systems** to improve endurance:

A) CONTINUOUS SYSTEMS

a) Continuous running (or biking, swimming...): It is the easiest system to improve endurance. You have to run for a long time without stopping, taking into account:

- Intensity should be moderate (between 55%-85% HRR)
- Rhythm should be uniform (always at the same speed)
- The track should be soft and flat. It improves principally **aerobic endurance**.

30' C.R.(continuous race) (65% HRR)

b) Fartlek (continuous variable): It consists in running in a continuous way but modifying the rhythm of the race. You have to take into account:

- The speed of the race changes (low, medium, high)
- Between 55% to 90% HRR
- The track should be varied.
- It improves both aerobic and anaerobic endurance.

Let's see an example for Fartlek in 35 minutes training session (to beginners):

Start - 6' warming up and soft stretching exercises.

Course:

1' easy running (60% HRR)-1' steady speed (85% HRR)

5 X 3' easy running (60% HRR)-1' steady speed (85% HRR)

1' easy running (60% HRR)-1' steady speed (85% HRR)

3' cooling down running (55% HRR) and stretching.

ACTIVITY: Now, you might develop a Fartlek training session adapted to your characteristics, it base on your Course Navete Results and your HR.

- Warming up:

- Fartlek instructions: (Include your HRR exactly)

- Cooling down:

c) Total training: It consists in combine different sources to make aerobic and anaerobic endurance bigger. It can include different activities and intensities: running, climbing, jumping, strength exercises...

B) INTERVAL TRAINING.

It consists in running a number of race series (between 5 and 20) over distances from 100 to 400 meters at maximal and submaximal intensity.

7 series x 100 m high insensitive

1.5 The **effects** of endurance training (**healthy profits**)

a) Cardiovascular system:

Improves blood circulation system: increase the size of the heart and the volume of blood **ejected** with each **beat**; **decreased heart rate** (beats per minute). In addition, it achieves **lowers blood pressure** and greater number of capillaries.

b) Respiratory system: **enhance** lung capacity and the oxygen using. The results are decreased **respiratory rate** and breathing becomes deeper.

c) Muscles enhancements: increased number of capillaries in muscle tissues, increased number of **mitochondria**, enhance energy deposits (glycogen, creatine, ATP), improve resistance to waste products.

d) Low and medium intensity activities use fat like a main fuel from 30 minutes physical activity, due to, endurance activities are a good way to maintain a good body composition.

2. **STRENGTH**

2.1 Concept

Strength is the capacity to use our muscles to resist or overcome a resistance.

2.2 Types of strength

There are three types of strength:

- **Maximum strength:** the bigger strength that is possible in a single maximum contraction (weightlifting) in relation to the person's potential. Lidia Valentin is a Spanish weightlifting champion.



- **Endurance Strength:** the capacity to maintain a strength activity with a lightweight over an extended period of time (walking up to top of the mountain).

- **Explosive strength:** the ability to overcome a resistance with a fast contraction and great speed (to throw a ball to the goal in handball, to jump for catching a rebound in basketball)



2.3 Easy ways to improve strength

Some of these easy ways are:

- Exercises using your body weight (abdominal exercises, push-ups or press-ups, squats...). **Might you look for exercises throughout new technologies?**



- Exercises with your classmates (pushing, lifting, carrying...)



- Exercises using **light materials** (medicinal balls, rubber band, sport benches...)

- Exercise traveling by urban jungle (parkour)



One efficient method to improve strength is **training in circuits**. This training consists in completing a circuit of 6 to 12 exercises (according to the age and the level of training of the students). **You may try to remember the circuit that we did at class and complete or improve it with new exercises or modifying them.**

Exercise 1:	Exercise 2:	Exercise 3:	Exercise 4:	Exercise 5:
Exercise 6:	Exercise 7:	Exercise 8:	Exercise 9:	Exercise 10:
Exercise 11:	Exercise 12:	Exercise 13:	Exercise 14:	Exercise 15:

2.4 Things to consider when working on strength

- Before strength training, we must do a **good warm up**.
- We will work all the parts of the body (balance strength development).
- We must work both sides (right and left)
- After a strength training, we will have to do flexibility exercises.

2.5 Effects of strength training

- Hypertrophy of muscle fibers: increase muscle size
- Improved muscle metabolism: improving using oxygen and energy substrates in muscle
- Increased muscle energy reserves
- Increased muscle tone: this will Prevent and reduce back injuries, and help to Maintain a correct posture

3. FLEXIBILITY

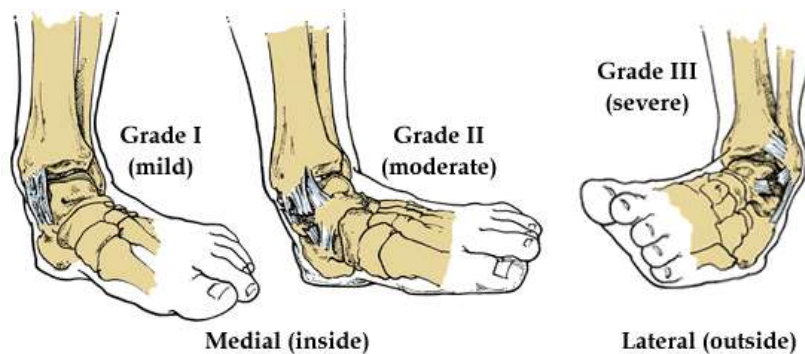
3.1 Concept

Flexibility, suppleness or stretching, they are the same thing. It is the ability to do movements in a big **range**; the ability to stretch or bend the body easily to its maximum **extent**. This ability is essential for sport practice and for our health. The unique basic physical condition that **decrease** from de birth.



A good suppleness level:

- Decrease the possibility to **suffer injuries** in joints and/or muscles: a fit flexibility level reduce the possibility to suffer a **ligaments sprain**, a **broke muscle fibre** or similar injuries.



- Better posture: high flexibility level's means a better posture and fewer aches and pains. Bad posture can lead to permanent deformity of the spine, as well as straining the abdominal muscles and back. It can also impair breathing, another way that flexibility affects performance.

The grade of flexibility, which a person has, depends on the muscle flexibility and the joint mobility. Therefore, we can say that:

FLEXIBILITY = JOINT MOBILITY + MUSCLE FLEXIBILITY

3.2 Training methods

a) **Active method:** the person can reach the desired positions on his/her own for 20-40 seconds. It should be convenient to repeat three or four times each exercise.



b) **Passive method:** the person can reach the desired positions with the help of another person or machine. Without this help, reaching these positions should be impossible. It should be convenient to repeat three or four times each exercise.



c) **Mixed method:** this method combine passive phase with active phase, like in Proprioceptive neuromuscular facilitation.

3.3 Factors limiting flexibility

- Sex: Women are usually more flexible than men are.
- Age: The younger you are, the more flexible you are.
- Temperature of the muscle: it must be the highest as possible. Increase body temperature reduce the body "density" tissues.
- Training: the specific suppleness development could improve your mobility.

3.4 Things to consider when working on flexibility

- Back: most movements need flexibility here. It's often injured because not many people have supple backs.
- Legs: flexibility at the knee and ankle is important for running and kicking. Most people are pretty supple here through walking.
- Hip: anything involving raising or lowering a leg needs you to bend at the hip. Not many people are flexible here. It's good place to test flexibility.

- Shoulder and arms: flexibility here helps with many sports - like throwing and swimming. Most people stretch these joints getting dressed in the morning.
- Strength training can limit flexibility - do plenty of stretching exercises as well.
- Remember to warm-up first
- Perform exercises lightly and for a long period of time (hold position for 20-40 seconds)
- Remember to do flexibility exercises (stretching) regularly

4. SPEED

4.1 Concept

Speed is a physical component that has a direct relationship with the nervous system and the muscular system. The movements your muscles make are coordinated and controlled by the brain and nervous system.



It is the ability to move or cover a distance as fast as possible.

4.2 Types of speed

a) **Speed reaction:** Is the ability to respond to a specific stimulus in the shortest time possible, for example, stop a goalkeeper or shot out of a 100-meter race.

b) **Movement speed:** is how quickly a person can carry out a movement or perform a skill (tennis serve, kicking a ball, hitting a baseball). Coordination is a very important factor in this type of speed, it's also related to a correct learning in the specific sport movement or technique.

In both types, the nervous system is going to be determining due to it is the organ that orders and regulates the movements of muscles.

c) **Displacement speed:** the ability to cover a certain distance as fast as possible. (How fast the runner can run, or the swimmer can swim). It depends on:

- Range of movement.
- Strength of muscles involved.
- Frequency of the movement.
- Correct technique.

4.3 Things to consider when working on speed

- Pay attention and be concentrated. Remember that speed is directly relationship with nervous system
- Perform short distances and short efforts. Activities speed range from a few hundredths of second up to 40 seconds.
- Warm up completely before to train speed.
- It is difficult to improve speed because it comes from genetics, but we can improve our speed. The development of speed is highly specific and to achieve it we should ensure that:
 - All speed workouts should include an appropriate warm up and cool down.
 - Flexibility is developed and maintained all year round (joint mobility and muscular elasticity)
 - Strength and speed are developed in parallel.
 - Skill development and coordination (technique) should be pre-learned, rehearsed and perfected before it is done at high-speed levels.
 - Speed training is performed by using **high velocity for brief intervals** (from a few hundredths of up to 40-50 seconds). This will ultimately bring into play the correct neuromuscular pathways and energy sources used.
 - Speed training intensity should be fixed about specific test. It is not able to fix intensity with heart rate.
 - It is necessary to rest from 48 to 72 hours between speed training sessions.
 - If in the same session more physical components are going to be worked, the training should start with speed

Bibliography and resources:

- <https://educacionfisicaplus.wordpress.com/>
- <http://educacionfisicajoanmiro.profitbc.com/>
- GCSE Physical Education. Complete revision and practice.
- <http://www.cdc.gov/physicalactivity/basics/glossary/>

Pictures from:

<http://www.melillaesdeporte.es/runbike/noticia/5987/una-pregunta-running-o-trail-#.VkmyuXYvfIU>

http://www.diariodeleon.es/noticias/deportes/lidia-valentin-suspiro-podio_935926.html

<http://planetacb.com/2014/06/23/novedades-del-mercado-nba-pau-gasol-rudy-gay-lebron-love-rose-wade-y-mas/>

<http://comunadeicaria.blogspot.com.es/2015/10/parkour-evolucion-del-arte-del.html>

<http://clearchiro.com/back-pain-relief/>

<http://www.hughston.com/hha/a.strain-sprain.htm>

http://www.elperiodicomediterraneo.com/noticias/la-cronica-de-castellon/uji-despide-nacional-otra-plata_17595.html