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100m Analysis: Principles of Proximity and Directionality Involved in Exercises Doing

Mercedes Campillo Piqueras

Universidad of Murcia, Spain
E-mail: mercedes_campillo@hotmail.com

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Abstract

The purpose of this work is to understand the causes of the variations takes place in both speed and acceleration as frequency and amplitude along the hectometer. As well as solving some issues related to these variations, such as: what point is the runner in a state of maximum speed at? Is it possible to endure full speed until the end?

Keywords: Athletics. 100m Smooth. Joint Mobility. Locomotion. Frequency. Amplitude.

1.0 Introduction

1.1 ***Athletics and its modalities.***

One of the main individual sports is athletics. Thus, the word athletics comes from the Greek word "atletes" and has as meaning every individual who competes in order to obtain recognition. This sport encompasses a set of disciplines grouped into races, jumps, pitches, combined events and marches. The development of these tests implies a broad body development allowing the development of their motor skills serving as preparation for the practice of other sports. Being the 100 meters smooth one of the most important modalities. Therefore, throughout this article we will focus on performing an analysis of this modality, with the objective of knowing when the runner reaches its maximum speed and knowing what elements influence it when working it.

2.0 Analysis of the 100 Meters and Justification of Its Aerobic or Anaerobic Nature.

2.1. Description

The test of 100 meters can be defined as one of the modalities found in athletics. In it the four main physical capacities intervene, predominantly speed. For a better knowledge of this we will define the concepts on which this test is based. Thus, by physical abilities we understand the set of capacities involved in the factors of execution of the movement and that represent its quantitative aspect (Marteniuk, 1976). In the same way, it is necessary to define the concept of speed. Redondo (2011) defines it as "the ability to develop a motor response in the shortest possible time".

The 100 meters is one of the tests "queens" of athletics, which consists of walking 100 meters (in a straight line and without obstacles) in the shortest time possible. It is one of the most important tests of athletics and the best sprinters usually cover it in 10 seconds. During the execution of the test, the sprinter must react quickly, accelerate quickly and for as long as possible, achieve maximum speed. Once you achieve this maximum speed, you should keep it as long as possible and minimize the loss of speed (Letzelter, 2006).

The 100 meter test has been analyzed in major competitions since the 1980s, and has given the opportunity to the coaches and the athletes themselves, to have more useful information about the internal and external indexes of the training load at the highest level. The analysis of the races of the best sprinters of the world in the specialty of 100 meters serves as reference for the technical evaluation and to rationalize the obtained results, in relation to the programming of the training and the preparation of the competitions at the highest level (Rosa and Saorín, 2014).

2.2. Justification of Its Anaerobic Nature.

During the practice of anaerobic exercises some specific muscle groups are activated intensively and are subjected to intense work for a few seconds, there is a repetition with very short time intervals and are carried out with breathing blockade practically (Soto, 2012). Therefore, it can be said that, the 100 meters smooth is a test that fits this description, it is an explosive test and that is done in a few seconds, requires a maximum intensity in a short duration. For this reason, it is considered as an activity of anaerobic nature. Deepening a little more, within the anaerobic pathway, we place the 100 meters smooth within the anaerobic alactic pathway that, citing McArdle *et al*. (2004), is the one that refers to tests of short duration and high intensity, and that need a rapid and immediate energy contribution.

The high-energy phosphates adenosine triphosphate (ATP) and phosphocreatine (CP) stored within the muscles provide this energy almost exclusively.

Regarding the physiological parameters that influence this test, some of these are:

- Metabolic Systems for Obtaining Energy

For the performance of any mechanical work a muscle contraction occurs. Fernández (2006), points out that the main means of storing and exchanging the energy necessary for muscle contraction is the ATP. The amount of this is limited and therefore it is necessary to resynthesize it through the anaerobic alactic pathway, via lactic anaerobic and aerobic route.

- Anaerobic Glycolysis

In this process, glucose is degraded to pyruvic acid, mediated by the intervention of specific enzymes. When pyruvic acid is reached, exercise intensity or cardiovascular imbalances at the beginning of the practice, do not offer sufficient oxygen availability and in this way, pyruvic acid cannot follow the aerobic oxidative path, being reduced to lactic acid (Rosa and Saorín, 2014).

- Internal and External Indices of the Training Load

As we have previously commented in the 100-meter test, the resynthesis of ATP is necessary through the anaerobic alactic pathway. But although this resistatization is necessary, it has been described that the exhaustion of this can occur in a margin of approximately 7-10 seconds (Badtcke, 1987, cited by McArdle, Match & Katch, 2004). Also, taking into account Mader (1976), the deposits of PC can facilitate energy in very high intensity exercises, in a duration of 4-6 seconds.

- The Respiratory Response

The fundamental mission of the respiratory system is to provide O_2 and eliminate the CO_2 originated in the metabolic processes, through the regulation of four fundamental processes: External pulmonary ventilation (VE), transport of O2 and CO_2 in blood plasma and hemoglobin, O_2 exchange and CO_2 in lungs and muscle tissue and overall regulation of respiration, by constantly adjusting the behavior of the partial pressures of O_2 and CO_2.

- The Muscular System and the Nervous System

In the test of 100 meters, the greater presence of fast fibers will facilitate the activity. According to authors such as Harre and Hauptmann (1987) the percentage of fast fibers can increase until puberty if appropriate stimuli are applied.

In this sense, Grosser (1992) states that sprinters have a higher percentage of fast fibers than other athletes. Also, if we want to achieve the increase in speed we must train mainly the stride

Corresponding Author: Mercedes Campillo Piqueras
Universidad of Murcia, Spain..
E-mail: *mercedes_campillo@hotmail.com*

frequency, which is related to muscle work. This is reflected in the statement made by Tabasnik (1991), cited by López Sulanys and Bilirs (2015), who says that "With training, the increase in speed in lower level athletes is mainly due to the stride width, while in qualified athletes the determining factor is frequency.

Taking into account these aspects in the following sections we will explain the exercises that must be done and that are necessary for the realization of this activity.

3.0 Phases of the 100m Test.

Most people think that the best way to achieve this race and get the best result is to run to the limit of each one's chances, but this statement is not correct since athletes cannot run at full speed for approximately 10 seconds the race lasts.

This fact has been studied and analyzed by different physiologists, who maintain that an effort cannot be maintained at maximum intensity more than six seconds. This statement is the so-called "law of six seconds" (García-Verdugo, 1971). If we analyze the career of the hundred meters in depth we can observe four phases. These variations in speed have been defined by Coach Eric Broom:

1. From the exit at 30 m. this phase is of rapid acceleration
2. From 30 to 60 m, slow acceleration phase
3. From 60 to 85 m.: constant speed phase.
4. Of the 85m. Until the end, phase of slow deceleration. "

We will now analyze the different phases:

• Fast acceleration phase (0-30m.)

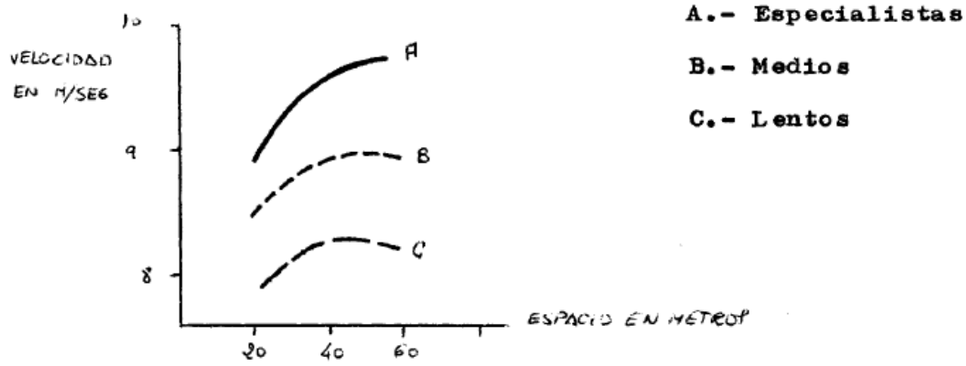
In this phase there is an increase in frequency and amplitude so that we are clear, I will define both concepts:

- Frequency is a quantity that measures the number of repetitions per unit of time of any phenomenon or periodic event. In this case the unit of time will be the seconds since it is a very light activity temporarily speaking.
- The amplitude is the distance we find between step and step. In this case between stride and stride.

• Slow acceleration phase (30-60m.)

In professional athletes this acceleration occurs from 30 to 60m, not happening in non-professional runners, where the speed decreases to 50 meters approx.

In the thesis of Mariano García-Verdugo (1971) for the realization of this work appears the following graph where it reflects the previously mentioned, that is to say, that less experienced runners stop accelerating before the most expert:



• Phase of the constant speed (60-85m.)

In this phase the maximum speed is maintained and depending on the capabilities of each runner it will last more or less. What is true is that even being a great athlete this period will last about 10 or 15 m. maximum.

• Final or deceleration phase (85-100m.)

Here, there is a reduction in speed that, as in the previous phases, depends on the possibilities of each player.

Once analyzed the phases that we can find in a race of one hundred meters we will emphasize the material required to carry out this sport.

4.0 Elements of the stadium

The athletic stadium has to comply with certain rules to make official the competitions and the results that take place in it. All facilities are regulated by the IAAF (dimensions, slope and design). According to article 160 of the IAAF, the length of a standard race track will be 400 m. The track will have two parallel lines and two curves whose radii will be the same. Unless it is a grass track, the interior of the track will be limited by a curb of appropriate material, approximately 5 cm. high and a minimum of 5 cm. Wide.

Material and equipment: A competition of athletics requires, for its high number of tests, an important material. For races (from 60 to 400 m) the presence of exit blocks is mandatory, if possible connected with a false exit control system. They allow a greater impulse and exits without landslides. In addition, the starting poles must indicate the "streets" attributed to the athletes. To approve the marks, the IAAF requires the presence of an anemometer to measure and record the wind speed, and a fully automatic timing system to the hundredth of a second.

The typical dress of an athlete is composed of a jersey, shorts and racing shoes. Those used by a sprinter have no heel or arch, and have 11 crampons that must not exceed 9 mm in length. The starting blocks: It is necessary to talk about the starting blocks, since they play a very important role in the putting into action of the athlete. These studs must meet certain requirements:

1. They must be subject to the playing field so that they do not move as this would reduce effectiveness.
2. The surface of the block must be firm and solid so that it allows a better support.
3. It must be high so that it allows a total contact between it and the foot and also be perpendicular for the drive to be more effective.

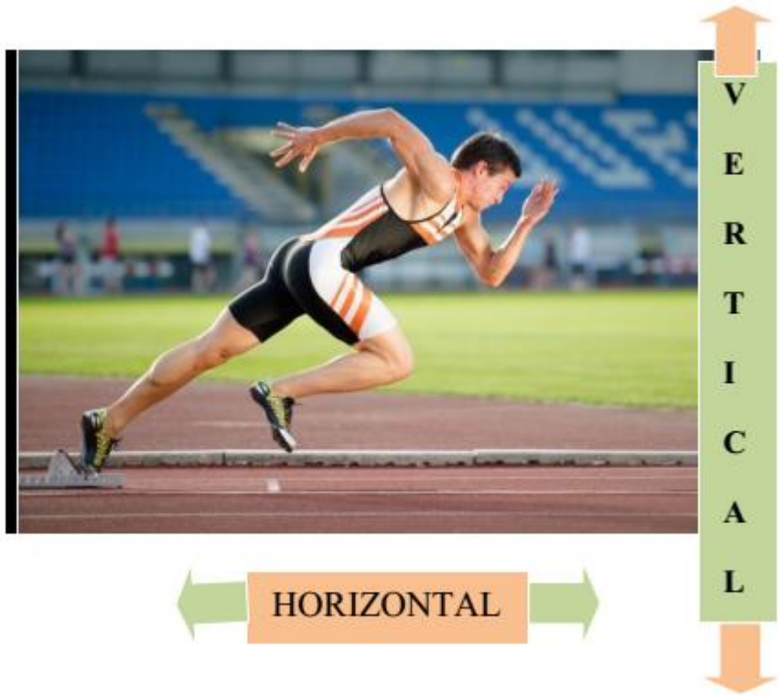
5.0 Principle of proximity to the activity and justification of the order of execution of the fundamental activities for the preparation of the main part.

It is necessary to perform a good phase of exercise preparation (FPE) to prepare the various systems that influence the performance of the main part, so these systems are: the osteo-articular and muscular, cardiovascular, respiratory and metabolic systems. For the execution of the main part to be more skillful it is necessary to increase the temperature of the organs and systems that are involved. Therefore, "if a correct preparation is made, a series of physical-chemical processes are activated that accelerate the intramuscular enzymatic activity and the transmission of neural stimuli of the motor axis, optimizing in this way the contractile response of the muscle fibers" (Rodríguez García, 2005). With good initiation to the activity, it is possible to favor the non-appearance of injuries that, in most of the occasions, appear due to the scarce or incorrect preparation.

The principle of proportionality has to do with the time that is used to stretch, that is, the distribution of the time that we are going to allocate to stretch according to the part of the body that we are going to use, depending on the priority. Since the activity that I am dealing with, the one hundred meters, is an anaerobic activity we must follow the following formula:

Locomotion + joint mobility 5 ', mobility of stretches 12`, application exercises 12'

6.0 Principles of vertical and horizontal directionality.



Following the previous drawing we can say that:

- The principle of *vertical directionality* is the preparation of muscle groups and joint nuclei so that the vertical axis is taken into account (Rodríguez García, 2008). Within this we can perform it following two directions: cranial-caudal direction, as well put in the scheme would be done from top to bottom; or caudo-cranial, from bottom to top. Specifically, for the initiation to the one hundred meters we must apply the principle of cranio-caudal directionality since the parts that participate more and that have more weight in the realization of this practice is the lower train. If, on the other hand, we would like to prepare for an exercise in which the participation of the upper body predominates, we should apply the precautionary-cranial principle.

- The horizontal *directionality*, taking into account Rodríguez García (2008) is determined by the degree of influence and tension that the rachis supports in the development of the exercise (mainly the lower back). Within it we will find a concentric or eccentric directionality. When it comes to a concentric directionality we will begin with exercises that begin in the extremities and conclude in the lumbo-abdominal area. On the other hand, when part of the lumbo-abdominal area towards the extremities, we will face an eccentric directionality.

In this case it would be appropriate to carry out an eccentric directionality since the muscle groups that have greater weight in the hundred meters are the lower extremities.

7.0 Detail of the Realization of Exercises to Be Carried Out: Articular Mobility, Stretching, Locomotion, Application Exercises.

The following are the exercises to be carried out for correct joint mobility, taking into account authors such as Alcaraz, J.M. and Ibáñez, I. (2011)

7.1 Articular Mobility

- **Superior Train**

Wrist: flexo-extension of the wrist→approach of the fingers to the inner side of the forearm and closeness of the fingers to the outer face of the forearm.

Elbow: flexo-elbow extension→approach and away from hand to shoulder.

Shoulder:

- Depression: shoulder drop. Lowering the shoulder as far as we can, should be done with one shoulder first and then the other.

- Elevation: lifting the shoulder. We raise the shoulder until we can then lower it.

- **Trunk**

Scapular waist:

Antepulsion: separation of the scapulae with the shoulders forward.

Retropulsion: approximation of the scapulae with the shoulders back.

Elevation: lifting the shoulders.

Trunk:

- Flexo-trunk extension: trunk tilt forward and backward

- Lateral inclination: deviation of the trunk to the side.

Pelvis:

Anteversion: displacement of the upper part of the hip forward.

Retroversion: displacement of the upper part of the hip backwards.

Lateral tilt: shift to one side of the hip.

Hip: approximation and distance of the knee to the anterior part of the trunk. Another exercise can be to raise one leg and then the other, which is, put one foot on tiptoe and then the other.

- **Lower Train**

Knee: flexo-extension of knees. We bend the knees until forming an angle 45º more or less. The legs have to be separated at the height of the shoulders and the back should be as straight as possible.

Ankle: sitting with one leg flexed and the other above it will make an ankle movement with the help of the hand, turning the foot to our face and away. With the same position as for the previous exercise, make small ankle rotations with the help of the hand.

Stretches

Sagittal spinal flexibilization in sextupedia: from knees and hands support, pelvic anteversion movement is done marking the lumbar lordosis. Next, pelvic retroversion is performed adopting total kyphosis of the spine.

FRF in prone position: from the prone position and extended arms forward, movements of lateral flexion to the right and left are made. The hands move in a semicircle.

FRS in supine decubitus: from supine decubitus with slight hip and knee flexion, anteversion and pelvic retroversion movements are performed.

Lumbares: from lateral decubitus, we adopt fetal position, locating the muscular stretch in the dorso-lumbar area.

Lumbar extension: in prone position and arms extended forward, a slight elevation of the trunk with tendency to stretch the spine to the maximum. At the end point of the concentric phase the contraction will be maintained for one second.

Abdominal: from lateral decubitus, maximum extension of the trunk will be performed, locating the stretch in the abdominal area.

Abductors: in sedentation, we perform abductor stretch. With one leg bent over the other extended and supporting an arm on it.

Adductors: in sedentary and supporting the hands behind the back, we perform adductor stretches.

Pelvic tilt: in supine decubitus and maximum hip flexion, the pelvis will be raised in slight retroversion. At the end point of the concentric phase the contraction will be maintained for one second.

Pelvic elevation: in supine decubitus and hip and knee flexion, the pelvis will be raised to align with the trunk at an angle of 45 degrees. At the end point of the concentric phase the contraction will be maintained for one second.

Isquiosural: in sedentary, with extended knees and ankles, a static and self-assisted stretching of the ischiosural musculature is performed.

Quadriceps: We perform quadriceps stretching by knee flexion and hip extension.

Application Exercises:

- Alternate jumps (kangaroos). [3-4x50-60 m].

- Alternate jumps with one foot. [3-4x50-60 m].

- Race with intention of the knee and active push of the foot + race. [3-4x50-60 m].

- Race elevating thigh +alternate jumps+race. [3-4x60-80 m].

- Race alternately raising the thigh and throwing the leg back (wheel). [3-4x10 "]

- Race in the place. [3-4x10 "]

- Sprint in progression of 15/25 / 35m

- Sprint 40/60 / 80m

8.0 Temporal Proportionality by Muscle Groups and Joint Nuclei

Joint Mobility Exercises (3 ')	SUPERIOR TRAIN	Trunk	**Scapular waist**		**25''**
		Arm	**Shoulder**		**25''**
			Elbow		**25''**
			Wrist		**25''**
	TRUNK		**Pelvis**		**30''**
			Trunk		**30''**
	LOWER TRAIN		**Ankle**		**45''**
			Knee		**45''**
			Hip		**45''**
Muscle Stretching Exercises	SUPERIOR TRAIN	**Arm**		**Triceps**	**1'**
				Biceps	**1'**
				Palm	**1'**
	TRUNK	**Lumbar paravertebral**			**1'**
		Pectoral			**1'**
		Abdominal(ABS)			**1'**
	LOWER TRAIN	**Leg**		**Quadriceps**	**2'**
				Ischiosural	**2'**
				Triceps sural	**2'**

The time used to perform the locomotion exercises together with those of joint mobility will be 5 minutes, within which we will dedicate two minutes for locomotion and the remaining three for joint mobility exercises.

Second, we will proceed to perform the relevant stretches to which we will dedicate an approximate time of 12 minutes, giving greater importance to the lower train since it will be the most involved in carrying out the activity (one hundred meters).

Finally the application exercises will take about 12 minutes, the time is less than if it were an aerobic activity since it requires a greater explosive force and a higher energy expenditure. The application exercises will be complicated and increasing the intensity to finally achieve the higher speed and resistance to perform this activity in the longest possible time.

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