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ASPECTS CONCERNING THE IMPORTANCE OF TECHNICAL IMPROVEMENT IN MIDDLE-DISTANCE TRACK RUNNING TRIALS

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Abstract: *No matter how "curious" or less credible it might seem, high performance in athletics equally depends on the correct manifestation of the technique of running in the dynamic of the movement components. Permanent monitoring of its kinematic parameters allows us to acquire important data for the improvement of the technique and boosts the efficiency of running. Unfortunately, as Moris Huvion says, there are so many specialists who, as a result of such studies, "see what they know, not what they have to".*
The purpose of the research is to analyse the key points of the midddle-distance track running trials by means of video analysis, in order to identify and remove both the unsatisfactory issues improperly acquired and the unnecessary movements occurring once the state of fatigue is experienced.

Keywords: *technique, running trials, video analysis.*

1. Introduction

Sports performance represents the area with the highest level of interest in terms of the dynamics of international scientific research in the field of sports. Studies in this direction have enabled researchers to exhibit different approaches.

According to Manno R. [3] training is “a complex intervention process, whose aim is learning and improving the technique, under a simple or chained form, for an individual, a group or a team and aimed at developing physical-psychic abilities allowing achieving maximum sports performance, taking into account the specific characteristics of the subject, group, or team ". Athletes do not develop overnight, and the coaches can't work miracles. There are no shortcuts, which explains that "adapting to your training is the sum of transformations caused by repeated, systematic exercise." [1]

The technique is important, primarily through the economy of movements and their effectiveness and as such it should

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not be understood in isolation, since it is subject to a large extent to the level of development of the conditional and coordination abilities, being closely related to the tactics, psychological, theoretical and artistic training, in the fields of sport that require this [5].

The role of technique in middle-distance and long-distance track running trials has become more and more important and consists in allowing the runners to accomplish effectiveness and ease in movement, which will allow crossing the distance at a higher speed.

In middle-distance track running, the physiological requirements influence the running technique.

The current synthetic track surfacing have imposed a perfected running technique, and the smallest mistakes in the technique can lead to fatigue in the lower limbs muscles.

During the training for perfecting the technique, a tendency to a simple, relaxed running stride, characterized by fewer useless movements that would negatively influence finishing the track in a better time.

The launching stride in middle-distance and long-distance running presents a series of special characteristics:

- running allows uniformity and fluency. This implies a more economical use of energy necessary for finishing the distance in less time;
- frequency and length of the stride had values which varied according to the somatic and functional characteristics of the athletes and the length of the running track;
- the running speed depends on the length and frequency of the steps; as the distance increases, the speed decreases, based on the decrease of the steps length, the frequency remaining the same, or in some cases, slowly rising;
- the ground contact allows the execution of a long enough stride, and the shock when touching the ground is not very strong. Some sportsmen step on the outer side of the foot, after which they step on the whole sole of the foot

Considering the previously mentioned information on the right running technique in long distance running trials and its importance in the energy save, it is obvious that a deficient technique determines the early occurrence of fatigue.

In the absence of a good physical training of the runners, the technique will not have the necessary support that can help it manifest itself with a high degree of accuracy and efficiency, and energy consumption will be much bigger, which leads to a lack of proper effort scaling during the races.

On a national and international scale, very little is said about these technical aspects connected to long-distance running, and the information that is available has become ideal and is very little detailed.

The vast majority of specialists focuses on addressing these middle distance and long distance running trials as means to develop motor capacity, endurance and improve the effort capacity of the athletes, ignoring the individual technical training because it calls for particular attention, especially when it is about coordinating body segments after the occurrence of fatigue during sustained effort, characteristic of running during training and competitions.

The solution to all these “problems” lies, obviously, in monitoring and assessing the technical preparation during training.

The technique is, from my point of view, one that could make the difference in saving energy and effort into optimal effort scaling, by removing unnecessary movements of the head and torso, by correcting the heavy stride in running and by finding the most appropriate ways of removing the imbalances between the upper and lower limbs.

2. The Hypothesis of the Preliminary Research

a. Investigation technologies for kinematic human movement can supply data aquisition that can highlight some relevant indicators for the running techniques in 1500 metres trials.
b. Kinematic data which characterizes middle-distrance track running through objectifying some biomechanical parametres may represent an individualised source of approach of sport training.

3. Materials and Methods

This study is attended by five athletes (four girls and a boy) registered at L.P.S. Galati. Based on video analysis, technical aspects of middle -distance track running will be highlighted, which, in case they are improved, could contribute to significantly increase the performance in this type of trials.

The methods used in achieving the research aims are the following: the study of the literature; the comparative method; the pedagogical and case study experimental method; the pedagogical observation method; the statistical mathematic of data processing and interpretation method; the graphic analysis of research results method; the testing method.

4. Conducting the Preliminary Experiment

The first test was carried out on June, 18th, 2017 on the “Danube Stadium” in Galati, videotaping the 1500 race with a GOPRO camera and a Phantom 3 Professional drone, on 5 subjects.

During the 18th and 25th of June, 2017, on the same stadium, the subjects used a 230 Garmin Forerunner watch throughout the race. Following the use of the watch, a series of interesting parameters have been achieved, data which cannot be detected with the naked eye. All the data has instantly been interpreted and quantified by its programmes.

I also used a soft for kinematic analysis of the running technique biomechanic named kinovea software

Kinovea is a video analysis software that allows capturing and playing, at different speed, of a video recording, with the possibility to analyse the kinematic parametres. Kinovea has been especially created to analyse motion in different sports in order to improve sport performance. [2], [4]

5. The Analysis of the Running Pace Technique

When discussing about technique, we need to consider two aspects, which, according to the level of acquisition, may influence the final result. These aspects are the trial technique and the running pace technique.

If we were to focus on a refined technique, we would consider a series of movements based on biomechanical laws, adequate to the purpose of the actions within the expert trial which contributes to obtaining high results.

In order to examine the short distance running techniques, we need to consider: whole body or segmental body movement in time and space and whole body or segmental body movement are characterised by: movement trajectory, made up of direction, length and shape, speed.

Neglecting technical training can turn into a disadvantage for athletes.

The cyclical unit of running is the running pace, namely the simple and double running pace.

Following the videotaping, the short distance running pose will be analysed taking into consideration the joints (hip, knee, ankle), the angles and the three stages: initial contact, mid stance and take off.

To conclude, based on the stages of the running pace, we shall graphically interpret and analyse, for each of the athletes involved in the preliminary experiment, the following aspects: angular speed, linear speed, joint angle, vertical plan position, total distance, vertical plan motion, angular acceleration, linear acceleration.

We shall further present the data obtained with the help of the Kinovea software regarding angular speed and vertical plan position for two of the five athletes.

6. Kinematic parametres analysis of athlete 1

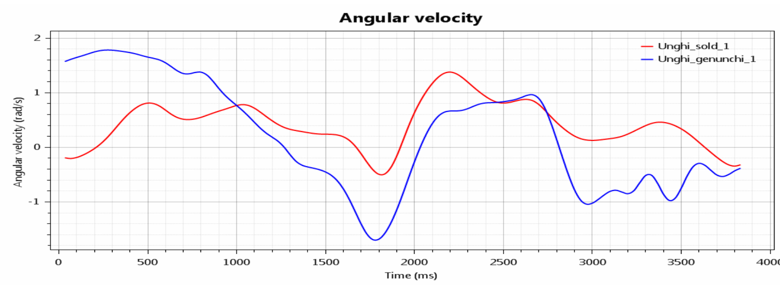

Chart 1. *Angular velocity for athlete 1*

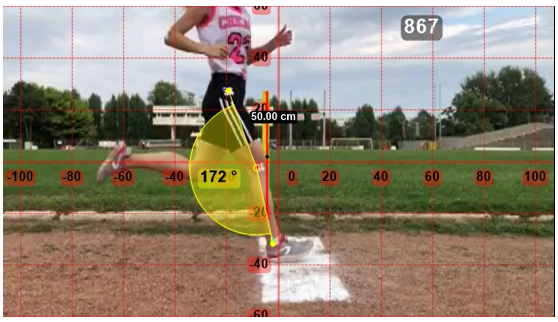

Fig. 1. *Athlete 1 at the initial contact for angular speed analysis*

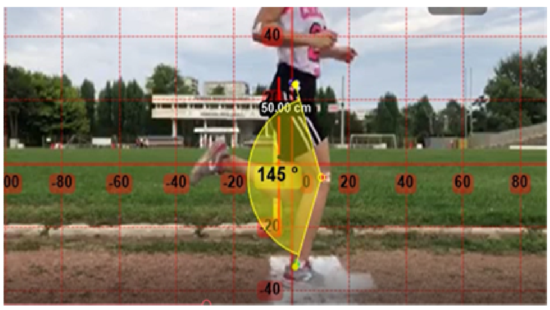

Fig. 2. *Athlete 1 at the mid stance for angular speed analysis*

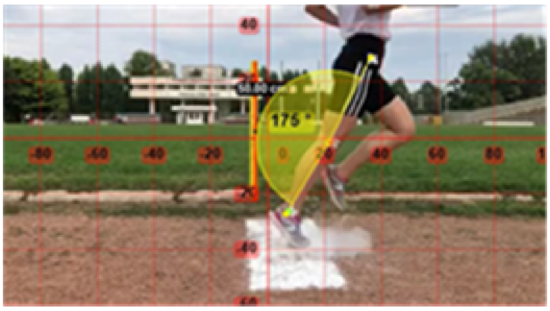

Fig. 3. *Athlete 1 at the take off for angular speed analysis*

Angular speed analysis

The initial contact (figure 1): for the first runner, this stage ranges between 1500 ms and 1900 ms. The angles of the two joints under study (the hip and the knee) are the same on the chart regarding the trajectory. Thus, the angle of the hip joint at 1500 ms is 0,20 rad/s and the knee joint is 0,60 rad/s.

From 1500 ms, the angular speed of both joints is the same, revealing a decrease. At 1900 ms, the angular speed of the hip joint equals -0,50 rad/s, and the knee joint speed is 2,30 rad/s.

The mid stance (figure 2); the angular speed of the hip joint, and also the speed the knee joint increases from -0,50 rad/s to 0,60 rad/s and from -2,30 rad/s to -0,80 rad/s at 2000 ms. We point out that on the chart the mid stance coincides with 1900 – 2000 ms time interval.

The take off (figure 3): occurs between 1900 ms and 2900 ms and the angular speed has the following features:

- the angular speed of the hip joint angle increases from 0,60 rad/s to 1,40 rad/s at 2400 ms, at then it decreases to 0,20 rad/s at 2900 ms. Within the 2400 ms and 2700 ms, there is a stagnation of speed at 0,80 rad/s.
- the angular speed of the knee joint has about the same route as the hip joint speed, except that it does not reach the same values and it has no stagnation moment.

At 2700 ms, the speed is approximately equal to 1 rad/s, and there is a considerate decrease until 2900 ms, reaching to -1 rad/s.

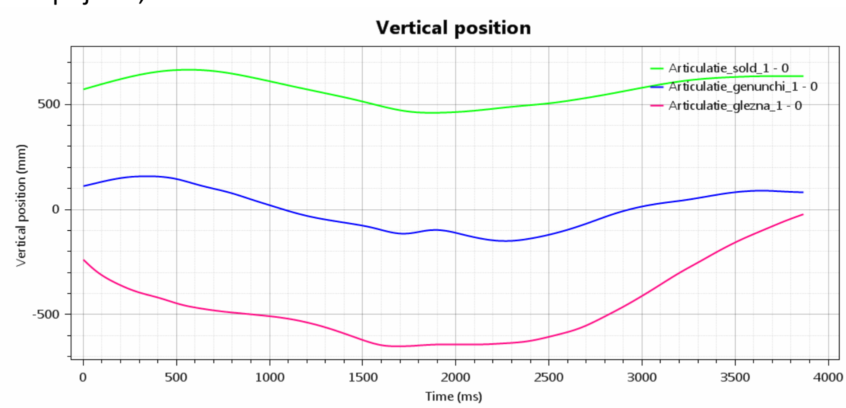

Chart 2. *Vertical position for athlete 1*

Position analysis on vertical plan

The initial contact (figure 4): this stage begins at 1533 ms, where the vertical plan motion of the hip joint is -75 mm, that of the knee joint is 200 mm and that of the ankle joint is approximately -400 mm.

The mid stance (figure 5): there is no vertical motion of the three joints at this stage. The hip joint reaches -75 mm at 100 mm.

Fig. 4. *Athlete 1 at the initial contact for position analysis on vertical plan*

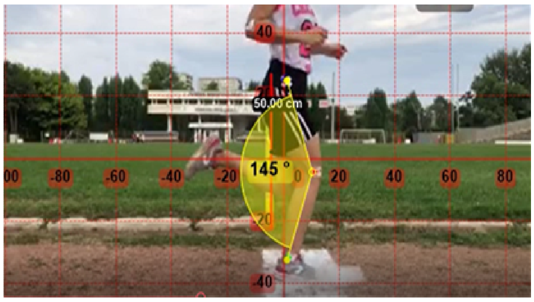

Fig. 5. *Athlete 1 at the mid stance for position analysis on vertical plan*

The take off (figure 6): is situated on the chart between 1900 ms and 2900 ms, and within this interval the motion of the joints is almostthe same, but at different values.

- the hip joint ranges between – 100 mm (1900 ms) and 0 mm (2900 ms);
- the knee joint ranges vertically between -200 mm (1900 ms) and 275 mm (2900 ms);
- the ankle joint ranges between -400 mm (1900 ms) and -190 mm (2900 ms). The motion happens between 2500 and 2900 ms.

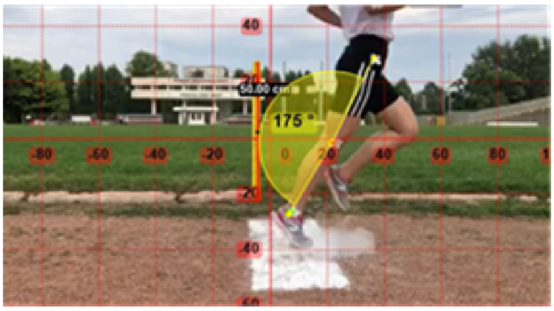

Fig. 6. *Athlete 1 at the take off position analysis on vertical plan*

7. Kinematic parametres analysis of athlete 2

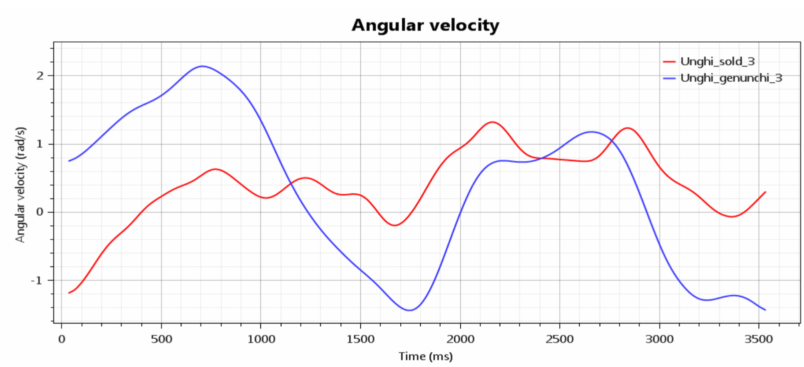

Chart 4. *Angular velocity for athlete 2*

Angular speed analysis

The initial contact (figure 7): starts at 1500 ms, where the angle of the hip joint is 0,20 rad/s and the angular speed of the knee joint is -0,80 rad/s.

The mid stance (figure 8); the angular speed of the 2 angles (the hip and the knee) at 1800 ms, or even within 1800 ms and 2000 ms is the same, increasing gradually. The angular speed of the hip joint angle is 0,25 rad/s, whereas the knee joint speed is approximately -1,40 rad/s.

The angular speed at this interval is 0,70 rad/s, and from 2500 ms to 2800 ms, a sudden decrease from 0,70 rad/s to 1,20 rad/s is observed, whereas at 2900 ms another decrease follows.

The angular speed of the knee joint angle at 2000 ms is 0 rad/s. stating at this .

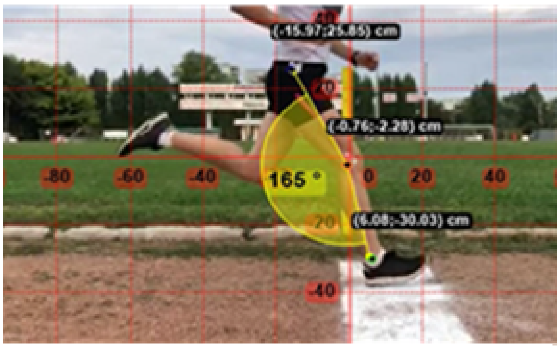

Fig. 7. *Athlete 2 at the initial contact for angular speed analysis*

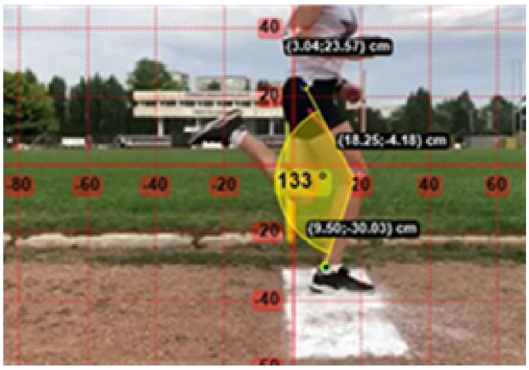

Fig. 8. *Athlete 1 at the mid stance for angular speed analysis*

The take off (figure 9): occurs between 2000 ms and 2900 ms, where the angular speed of the hip and knee angle has the following features:

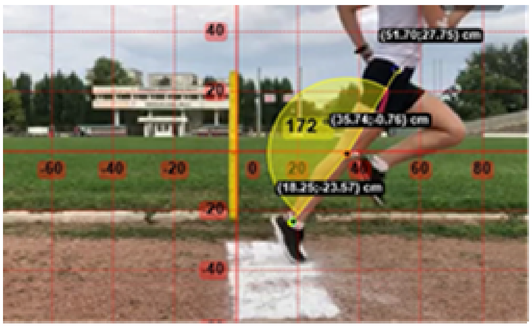

Fig. 9. *Athlete 1 at the take off for angular speed analysis*

The angular speed of the hip joint angle at 2000 ms is 0,90 rad/s and it increases to 1,35 rad/s at 2150 ms, at which point it coincides with the beginning of a decrease within the 2150 ms and 2700 ms.

The angular speed of the knee joint angle at 2000 ms is 0 rad/s. stating at this point it increases to 2200 ms, reaching approximately 0,80 rad/s. within 2200 ms and 2400 ms, the angular speedstagnates, and within 2400 ms and 2650 ms, there is another increase spurt to 1,20 rad/s. from 2650 ms to 2900 ms, the angular speed will follow a constant decrease, reaching a value of 0,20 rad/s.

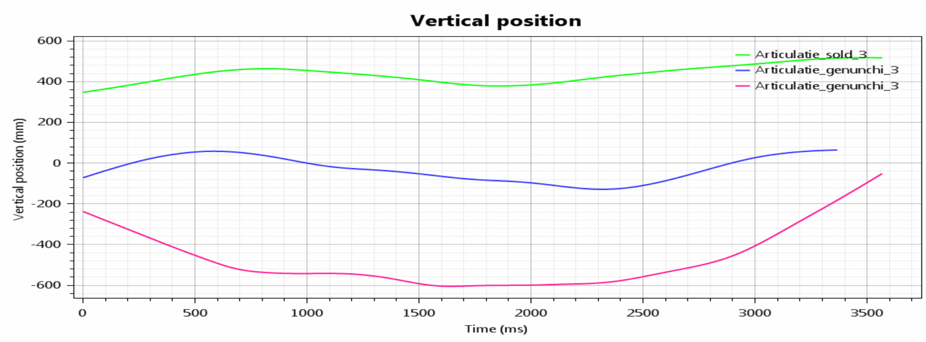

Chart 5. *Vertical position for athlete 2*

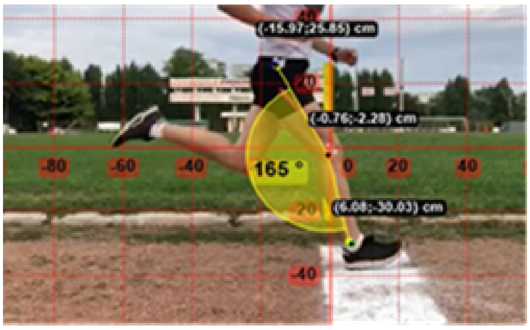

Fig. 10. *Athlete 2 at the initial contact for position analysis on vertical plan*

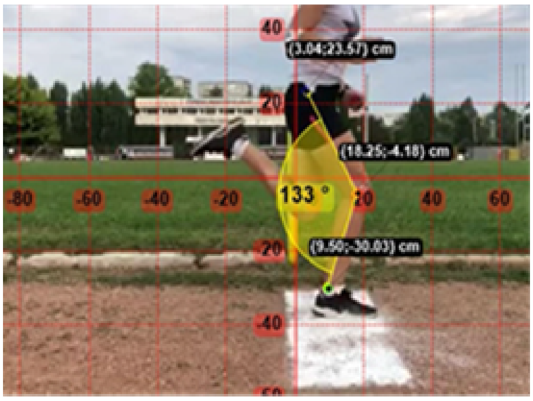

Fig. 11. *Athlete 2 at at the mid stance for position analysis on vertical plan*

Position analysis on vertical plan

<u>*The initial contact*</u> (figure 10): at 1500 ms:

- the hip joint vertical position is 400 mm;
- the knee joint vertical position is -0,50 mm;
- *the* ankle joint vertical position is -600 mm.
- the ankle joint reaches approximately -350 mm.

<u>*The mid stance*</u> (figure 11): within the 1800 ms and 2000 ms, the three joints have the following values:

- the hip joint reaches 350 mm, the knee joint is 100 mm, and the ankle is -600 mm. To be noticed that the vertical plan does not change during this stage in either of the three joints.

<u>*The take off*</u> (figure 12): is situated between 2000 ms and 2900 ms, but within the 2000 ms and 2900 ms interval,the vertical position of the three joints (hip, knee, ankle) does not change. Within 2400ms and 2900 ms, there is a change in the vertical position, thus:

- the hip joint reaches approximately 500 mm;
- the knee joint =0 mm;

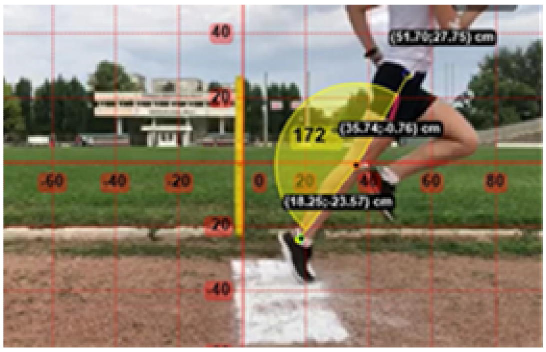

Fig. 12*. Athlete 2 at the take off position analysis on vertical plan*

8. Conclusions

1. It has been recorded that in order to train for short distance running trials for young athletes, it is of uttermost importance, as early as the selection stage, to train proprioceptively, based on the information reported by the analysers, which, by practising the means selected within this modern method, lead to developping and perfecting the technical execution specific to the trial, thus forming the abilities of combining, joining and segmentally coordinating , developing the sense of spacial-temporal direction, kinesthetic differenciation and stato-dynamic balance.
2. It has been recorded that individualised data of the quantitative level of the independent variables along the training stages of the athlete facilitate objective monitoring of the technicality level. Moreover, it ensures the development of the qualitative level of training, based on the implementation of technical intervention programmes which are centred on this objective.
3. The analytical use of the kinetic parametres, by means of videotaping complete and scientifically argue the direct guidance of technicians, through individual programmes of technical and physical training, in the purpose of achieving individual performance of procedures and elements specific to long distance running.

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